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ABSTRACT

This discussion draft reviews trends in Canada's apprenticeship system over the last 20 years and then examines prospects for labor market conditions for Canada's total economy and for the construction sector to the year 2005. The apprenticeship system has a number of serious weaknesses, including the following: (1) the stagnation in new apprenticeship registrations in the 1990s, in contrast to increased enrollment in other postsecondary programs; (2) the inability of the apprenticeship system to expand beyond traditional fields; (3) the inability of the apprenticeship system to increase the extremely low proportion of women (3 percent) enrolled in apprenticeship programs; (4) the uneven development of apprenticeship programs by province; (5) the very low level of completion rates for apprenticeship programs (9.5 percent); and [6] the strong downward trend in apprenticeship completion rates, declining one-third over the past 2 decades. The trends raise serious questions about the ability of the apprenticeship system in Canada to produce an adequate supply of qualified workers for the economy. Attention should be focused on the reasons why Canada's apprenticeship system appears unable to get its apprentices to complete their programs in a timely manner, if at all; why the system has not expanded outside traditional occupations; and why women are not attracted to apprenticeship programs. (Contains 25 references and 36 tables.) (KC)

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Apprenticeship in Canada: A Training System Under Siege?

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December 1999

Draft for Discussion

Report prepared by the Centre for the Study of Living Standards for the National Apprenticeship Committee of the Canadian Labour Force Development Board

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Apprenticeship in Canada:
A Training System Under Siege?

Report prepared for the CLFDB National Apprenticeship Committee

Second Draft
December 16, 1999

Andrew Sharpe
Executive Director
Centre for the Study of Living Standards

Executive Summary

Apprenticeship in Canada: A Training System Under Siege?

This paper first reviews apprenticeship trends in Canada over the last two decades. It then examines prospects for labour market conditions for the total economy and for the construction sector to the year 2005 based on scenarios developed by the forecasting firm Informetrica for the IAS committees examining labour market trends in the construction trades.

The paper finds that the apprenticeship system has a number of serious weaknesses, including:

- the stagnation in new apprenticeship registrations in the 1990s. This situation lies in stark contrast to increased enrolment in other post-secondary educational programs;

- the inability of the apprenticeship system to expand beyond traditional fields such as the construction trades and motor vehicle repair into growing occupations in business and commerce, health sciences, natural sciences, and social sciences;

- the inability of the apprenticeship system to increase the extremely low proportion of women enrolled in apprenticeship programs (3 per cent);

- the uneven development of apprenticeship programs by province, resulting in regional disparities in access to apprenticeship programs;

- the very low level of completion rates for apprenticeship programs (9.5 per cent) due to the high drop out rate. This completion rate is much lower than in other types of education and training; and

- the strong downward trend in apprenticeship completion rates, declining one third over the past two decades.

The trends described in this paper raise serious questions about the ability of the apprenticeship system in Canada to produce an adequate supply of qualified workers for the economy. As suggested by the title of this paper, the apprenticeship system may be under siege.

When there is weak demand for qualified workers, the deficiencies of the apprenticeship system may have limited consequences. Since large increases in the number of qualified workers are not needed, the low apprenticeship completion rates do not represent an obstacle to growth. Employers do not put pressure on the apprenticeship system to become more effective. In contrast, strong demand for qualified workers makes employers more aware of the deficiencies of the apprenticeship system and creates demand for reforms.

It is possible, that under certain conditions as found in the optimistic scenario outlined in the second section of the paper, future demand for new entrants in

construction trades could be very strong, resulting in shortages given the limited supply of journeypersons who successfully complete apprenticeship programs. If labour demand exceeds labour supply, creating labour shortages, attention will be directed toward the inability of the apprenticeship system to produce an adequate supply of skilled tradespersons.

If external pressure arising from a tight labour market on the apprenticeship system to reform continues to be weak, the impetus to reform the apprenticeship system must come from inside the system.

Attention should focus on the reasons why Canada's apprenticeship system appears unable to have its apprentices complete their programs in a timely manner, if at all; why the apprenticeship system has not expanded outside traditional occupations; and why women are not attracted to apprenticeship programs.

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Apprenticeship in Canada: A Training System Under Siege?

A key concern of those responsible for managing Canada's labour market is that the apprenticeship system be responsive to labour demand developments and that it produces an adequate supply of well-trained journeypersons in a cost-effective and timely manner. The objective of this paper is to assess the effectiveness of Canada's apprenticeship system and to discuss the implications of this situation for the labour market.

The paper recognizes that apprenticeship is a provincial jurisdiction and that apprenticeships systems vary greatly by province both in their rules and regulations and in their importance. For this reason, it may be misleading to speak of a common and consistent national apprenticeship system, just as it may be misleading to speak of a national education system in Canada. Nevertheless, we believe many or most provinces are experiencing similar trends in their apprenticeship programs and that it is useful to conduct analysis of these trends at the national level, recognizing of course that not all provinces may be experiencing these trends.

I Trends in Canada's Apprenticeship System

The supply of labour to feed the demand for workers in a given sector comes from a number of sources: increased weekly hours of those already employed, employment for those unemployed, intersectoral mobility, interprovincial mobility, and new entrants. The exit rate from the sector also affects the overall labour supply. This paper is primarily concerned with the supply of new entrants produced by the apprenticeship system, which trains the labour force mainly for the construction trades and motor vehicle repair.

Apprenticeship registrations

The main source of information on apprenticeship trends in Canada is the administrative data base on apprenticeship registrations and completions maintained by Human Resources Development Canada and Statistics Canada. It is based on information provided by the provincial directors of apprenticeship. Data on registrations for 229 trades by trade at the start of the period, new registrations, completions, registrations at the end of the period, discontinuations, certifications, and IPS (red seal) certifications are available for Canada for the years 1977-97 and for the provinces 1980-97.

According to this data base, over the last 20 years the number of persons registered in apprenticeship programs in a given year, which includes both persons registered at the start of the year and new registrations during the year, has risen 40.2 per cent from 122.9 thousand in 1977 to 172.3 thousand in 1997 (Table 1 and Chart 1). At the same time, the size of the total labour force has also risen 41.4 per cent, so apprentices as a share of the labour force has remained more or less constant at 1.1 per cent over the period.

Most apprentices are under 45 so it may be more appropriate to compare trends in apprenticeship registration with trends in the size of the labour force aged 15-44. As

Table 1 and Chart 2 show, total apprenticeship registrations as a share of the labour force 15-44 has also been fairly steady, rising slightly from 1.56 per cent in 1977 to 1.61 per cent in 1997, compared to a stable 1.1 per cent for the total labour force. Slower growth in the labour force aged 15-44 compared to the overall labour force (36 per cent versus 41.4 per cent) explain this divergence.

Within the 1977-97 period, there have been large fluctuations in the absolute and relative number of apprentices, with the peak in 1991 at 192.9 thousand (1.34 per cent of the labour force). Apprenticeship registrations appear strongly cyclical, rising during expansions when jobs are plentiful and enrolment in apprenticeship programs relatively easy (to enroll the potential apprentice must find an employer willing to take him or her on) and falling during recessionary periods when the relative scarcity of jobs dampens new registrations (although it may also delay completions and hence keep up total registrations).

Registrations rose rapidly during the second half of the 1970s, peaking in the recession year of 1982. The low level of economic activity in the 1983-85 period dampened registrations, but economic expansion in the second half of the 1980s again boosted registrations, which peaked in 1991. Again the weak economy of the first half of the 1990s had a negative effect on registrations, but the upturn starting in the second half of the decade has lead to an increase in total registrations. Indeed, total registrations jumped by 5,854 in 1997, the most recent year for which data are currently available. With strong output growth in both 1998 and 1999, it is likely that registrations have increased in both years.

Another source of information on apprenticeship trends is Statistics Canada's publication *Education in Canada*, which provides data on enrolments in programs for registered apprentices. According to this source (see Table 2), total apprenticeship enrolment fell 23.2 per cent from 68,119 in 1983-84 (the earliest year for which data are available) to 52,290 in 1995-96 (the most recent year for which data are currently available). This compares with a 18.3 per cent increase between 1983 and 1995 from the Statistics Canada/HRDC apprenticeship data base.

The smaller number of apprentices in the enrolment series reflects the fact that this series captures only apprentices enrolled in classroom instruction, not those on the job. One possible explanation for the discrepancy between the trends in the two series may be that a smaller proportion of apprentices in any given year are now enrolled in classroom instruction. In certain provinces it is now possible to "challenge" or take the apprenticeship exam without completion of the classroom component of the program. The cyclical nature of apprenticeship activity comes through in the enrolment statistics as it does in the registration data, with significant increases in enrolment between 1987 and 1991.

Table 1: Trends in Apprenticeship in Canada.

YEAR	*Reg. Total*	Reg. Total as % of LF 15+	Reg. Total as % of LF 15-44	*Completions*	*Completions as % of Registrations*	*New Registrations*	*Reg. End*	*Discontinuations*	*Red Seal Certificate*	*Red Seal Certificate as % of Completions*
1977	122,908	1.132	1.559	17,427	14.18	30,043	97,679	25,229	14,328	82.22
1978	130,334	1.157	1.586	19,034	14.60	32,703	94,794	35,540	15,473	81.29
1979	135,415	1.164	1.586	18,163	13.41	36,407	101,839	33,576	14,577	80.26
1980	138,673	1.157	1.568	15,096	10.89	43,676	113,192	25,481	9,075	60.12
1981	153,140	1.242	1.674	15,340	10.02	39,732	123,612	29,528	7,910	51.56
1982	155,125	1.251	1.686	20,786	13.40	29,926	120,026	35,099	9,011	43.35
1983	139,098	1.103	1.483	15,657	11.26	19,236	110,755	28,343	8,118	51.85
1984	138,235	1.076	1.440	19,335	13.99	27,637	102,729	35,506	10,151	52.50
1985	139,199	1.061	1.418	19,092	13.72	37,319	108,492	30,707	9,093	47.63
1986	154,226	1.153	1.531	17,105	11.09	41,701	123,029	31,197	6,303	36.85
1987	156,857	1.151	1.533	17,258	11.00	44,604	124,688	32,169	6,985	40.47
1988	162,064	1.166	1.558	17,296	10.67	38,327	128,831	33,233	7,675	44.37
1989	174,663	1.234	1.652	17,614	10.08	48,615	138,289	36,374	9,414	53.45
1990	192,332	1.342	1.804	17,804	9.26	48,438	157,106	35,226	7,850	44.09
1991	192,946	1.339	1.812	19,724	10.22	32,306	157,166	35,780	8,588	43.54
1992	180,963	1.250	1.712	18,720	10.34	28,948	139,744	41,219	8,400	44.87
1993	168,983	1.152	1.593	18,411	10.90	30,624	132,617	36,366	8,381	45.52
1994	165,668	1.117	1.560	16,801	10.14	32,007	128,756	36,912	7,134	42.46
1995	164,569	1.102	1.550	17,073	10.37	35,234	131,322	33,247	7,858	46.03
1996	166,489	1.099	1.559	16,092	9.67	34,614	132,189	34,300	8,060	50.09
1997	172,343	1.122	1.606	16,383	9.51	39,840	137,226	35,117	8,522	52.02

Source: Statistics Canada/HRDC Apprenticeship Database, August 1999; Labour Force Survey, Statistics Canada.

Chart 1: Trends in Apprenticeship in Canada

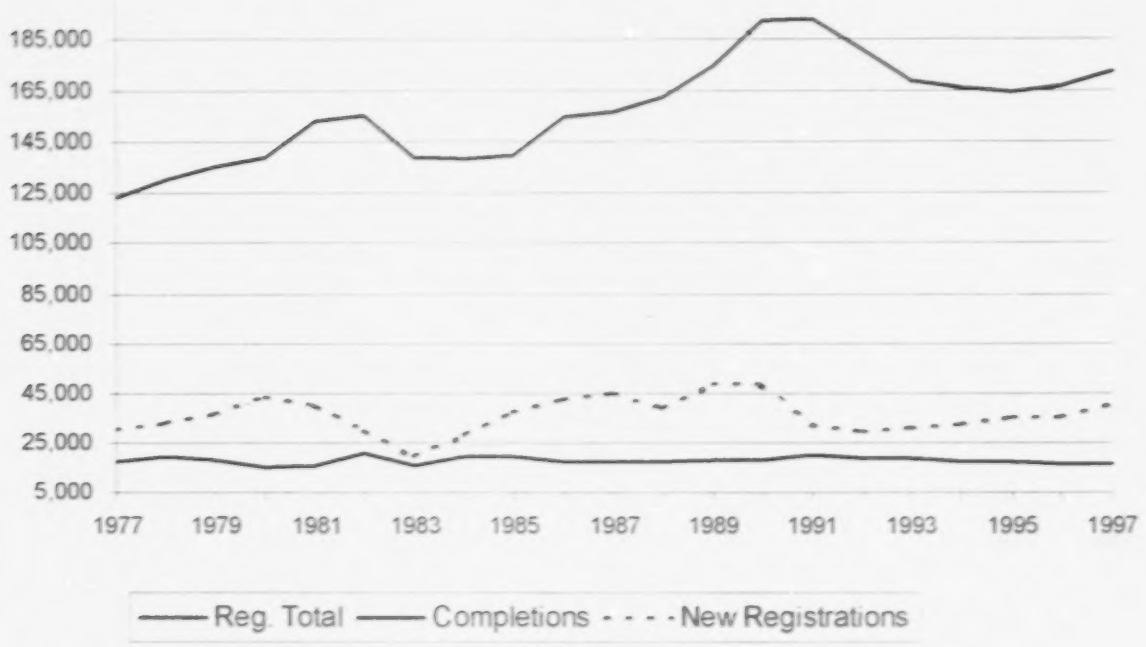

Chart 2: Apprenticeship Registration in Canada

(total registrations as a proportion of 15-44 age group)

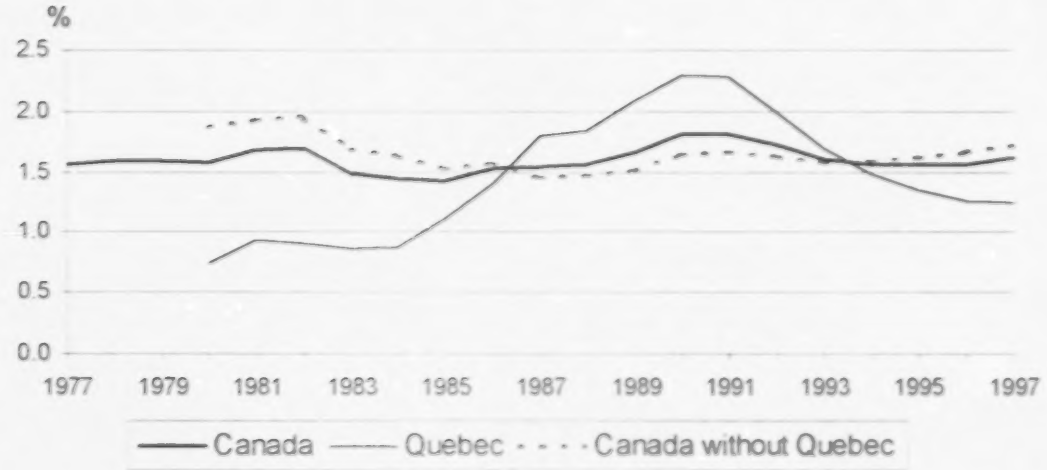

Table 2
Enrolment in Programs for Registered Apprentices in Canada

	All Programs	Engineering and Applied Sciences Programs
1983-84	68,119	62,852
1984-85	57,512	51,582
1985-86	58,406	51,321
1986-87	53,315	48,007
1987-88	47,979	42,896
1988-89	52,282	47,076
1989-90	56,205	50,946
1990-91	60,232	55,102
1991-92	62,891	57,536
1992-93	56,874	52,030
1993-94	52,153	47,559
1994-95	50,815	46,034
1995-96	52,290	46,970

Source: 1983-84/86-87- *Education in Canada: A Statistical Review for 1987-88*, cat. 81-229, Statistics Canada, August 1989; 1987-88/89-90- *Education in Canada: A Statistical Review for 1992-93*, cat. 81-229, Statistics Canada, December 1994; 1990-91/95-96- *Education in Canada, 1998* cat 81-229, Statistics Canada, June 1999.

Apprenticeship by province

The apprenticeship system is under provincial jurisdiction and enrolment in apprenticeship programs vary greatly by province (see Table A1 in the appendix). For example, in Quebec apprentices complete their course requirements before taking positions with employers.

There have been large fluctuations in apprenticeship enrolment in Quebec. To gain a deeper understanding of apprenticeship trends in Canada, it is useful to disaggregate the data for Canada given in Table 1 and Chart 1 into data for Quebec (Table 3 and Chart 3) and data for Canada without Quebec (Table 4 and Chart 4).

In Quebec, registrations rose rapidly in the 1980s from 17,163 in 1980 to a peak of 60,899 in 1991, 2.3 per cent of the labour force aged 15-44. Since then registrations have steadily fallen, reaching 31,640 in 1997, 1.2 per cent of the labour force aged 15-44.

When the Quebec data are removed from the national data, a distinct downward trend emerges for apprenticeship registrations. As a share of the labour force aged 15-44, apprenticeship registrations in Canada without Quebec fell from an average of 1.91 percent in 1980-82 to 1.67 per cent in 1994-97 (Chart 2).

Table 3
Apprenticeship Registration by Province, 1997

	Registrations	% of Total Registrations	Population 15+, thous.	% of Total Population
Ontario	63,987	37.13	8,979	37.91
Alberta	34,214	19.85	2,159	9.11
Quebec	31,640	18.36	5,926	25.02
British Columbia	20,243	11.75	3,100	13.09
Saskatchewan	5,636	3.27	760	3.21
Nova Scotia	4,259	2.47	742	3.13
New Brunswick	3,939	2.29	603	2.55
Manitoba	3,628	2.11	861	3.63
Newfoundland	3,532	2.05	450	1.90
Prince Edward Island	409	0.24	107	0.45
Canada	172,343	100.00	23,687	100.00

Source: Appendix Table A1; Labour Force Survey, Statistics Canada.

Apprenticeship enrolment in Canada is largely concentrated in the four largest provinces, with these provinces in 1997 accounting for 87.1 of total apprenticeship enrolment (Table 5): Ontario (37.1 per cent of the total), Alberta (19.9 per cent), Quebec (13.4 per cent), and British Columbia (11.8 per cent).

Alberta's share of national apprenticeship enrolment is more than double its population share (9.1 per cent), while Ontario's share is also slightly above its population share (37.9 per cent). On the other hand, Quebec's share of apprenticeship registrations is nearly 7 percentage points below its population share (25.0 per cent).

Apprenticeship by trade

Table 6 presents data for 1977, 1991 and 1997 on total apprenticeship registrations for the most important 25 trades in 1997[1] The three trades with the largest apprenticeship registration in 1997 were construction electricians (19,771), carpenters (18,688), and automotive service technician (17,368), which alone accounted for nearly one third (32.4 per cent) of all registrations at the start of period. Apprenticeship registrations were also greatest in these three trades in 1977 and 1991 and their importance even larger (43.6 per cent and 36.9 per cent respectively).

[1] See Tables A2 in the appendix for annual registration data for these trades over the 1977-97 period.

Table 4: Trends in Apprenticeship in Quebec.

YEAR	*Reg. Total*	Reg. Total as % of LF 15+	Reg. Total as % of LF 15-44	*Completions*	*Completions as % of Registrations*	*New Registrations*	*Reg. End*	*Discontinuations*	*Red Seal Certificate*	*Red Seal Certificate as % of Completions*
1980	17,163	0.556	0.742	n/a	n/a	8,279	17,078	8,364	-	-
1981	22,109	0.706	0.937	2,704	12.23	4,831	17,520	9,420	-	-
1982	21,035	0.682	0.908	1,743	8.29	2,515	17,520	6,030	-	-
1983	20,442	0.651	0.863	1,372	6.71	2,922	16,105	7,259	-	-
1984	21,050	0.658	0.867	1,417	6.73	4,752	17,858	7,944	-	-
1985	27,464	0.840	1.104	1,696	6.18	9,606	24,409	12,661	-	-
1986	35,588	1.074	1.402	1,693	4.76	11,179	31,233	15,534	-	-
1987	45,929	1.357	1.784	2,245	4.89	14,696	39,793	20,832	-	-
1988	47,806	1.388	1.835	2,686	5.62	8,013	40,546	15,273	-	-
1989	54,524	1.567	2.079	2,878	5.28	15,142	44,525	25,141	-	-
1990	60,899	1.725	2.300	2,931	4.81	11,893	51,314	21,478	-	-
1991	59,184	1.681	2.271	3,064	5.18	7,381	51,301	15,264	-	-
1992	50,982	1.449	1.987	2,624	5.15	5,940	36,380	20,542	-	-
1993	43,121	1.216	1.682	1,977	4.58	6,242	33,132	16,231	-	-
1994	37,881	1.054	1.473	1,396	3.69	4,544	29,070	13,355	-	-
1995	34,344	0.951	1.344	1,538	4.48	5,179	26,215	13,308	-	-
1996	32,008	0.879	1.251	1,545	4.83	5,675	25,293	12,390	-	-
1997	31,640	0.869	1.237	1,531	4.84	6,242	25,823	12,059	-	-

Source: Statistics Canada/HRDC Apprenticeship Database, August 1999; Labour Force Survey, Statistics Canada.

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Table 5: Trends in Apprenticeship in Canada without Quebec.

YEAR	*Reg. Total*	Reg. Total as % of LF 15+	Reg. Total as % of LF 15-44	*Completions*	*Completions as % of Registrations*	*New Registrations*	*Reg. End*	*Discontinuations*	*Red Seal Certificate*	*Red Seal Certificate as % of Completions*
1980	121,510	1.366	1.860	n/a	n/a	35,397	96,114	17,117	9,075	n/a
1981	131,031	1.424	1.930	12,636	9.64	34,901	106,092	20,108	7,910	62.60
1982	134,090	1.440	1.948	19,043	14.20	27,411	102,506	29,069	9,011	47.32
1983	118,656	1.253	1.692	14,285	12.04	16,314	94,650	21,084	8,118	56.83
1984	117,185	1.214	1.634	17,918	15.29	22,885	84,871	27,562	10,151	56.65
1985	111,735	1.134	1.525	17,396	15.57	27,713	84,083	18,046	9,093	52.27
1986	118,638	1.179	1.574	15,412	12.99	30,522	91,796	15,663	6,303	40.90
1987	110,928	1.083	1.449	15,013	13.53	29,908	84,895	11,337	6,985	46.53
1988	114,258	1.093	1.465	14,610	12.79	30,314	88,285	17,960	7,675	52.53
1989	120,139	1.126	1.511	14,736	12.27	33,473	93,764	11,233	9,414	63.88
1990	131,433	1.217	1.640	14,873	11.32	36,545	105,792	13,748	7,850	52.78
1991	133,762	1.229	1.663	16,660	12.45	24,925	105,865	20,516	8,588	51.55
1992	129,981	1.185	1.624	16,096	12.38	23,008	103,364	20,677	8,400	52.19
1993	125,862	1.132	1.565	16,434	13.06	24,382	99,485	20,135	8,381	51.00
1994	127,787	1.137	1.587	15,405	12.06	27,463	99,686	23,557	7,134	46.31
1995	130,225	1.151	1.615	15,535	11.93	30,055	105,107	19,939	7,858	50.58
1996	134,481	1.169	1.656	14,547	10.82	28,939	106,896	21,910	8,060	55.41
1997	140,703	1.201	1.722	14,852	10.56	33,598	111,403	23,058	8,522	57.38

Source: Statistics Canada/HRDC Apprenticeship Database, August 1998; Labour Force Survey, Statistics Canada.

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Chart 3: Trends in Apprenticeship in Quebec

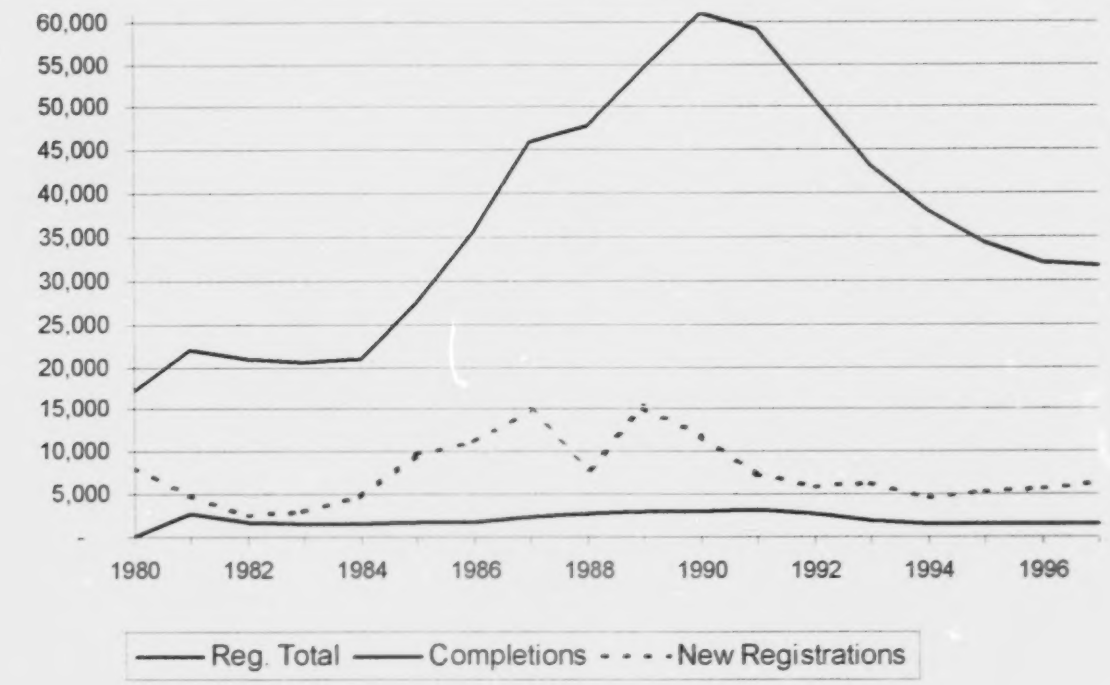

Chart 4: Trends in Apprenticeship in Canada without Quebec

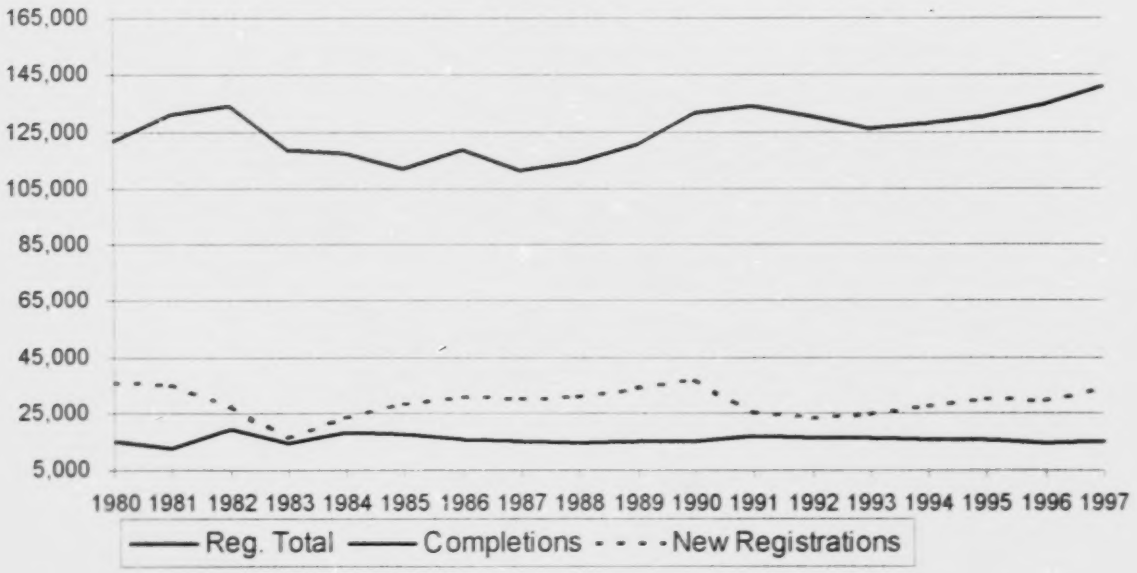

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Table 6

Apprenticeship Registrations in Major Trades (total registrations)

	1977	%	1991	%	1997	%
Construction Electrician	19,065	15.51	24,605	12.75	19,771	11.47
Carpenter	18,090	14.72	26,889	13.94	18,688	10.84
Automotive Service Technician	16,392	13.34	19,611	10.16	17,368	10.08
Hairdresser	3,051	2.48	4,154	2.15	9,051	5.25
Industrial Mechanic (millwright)	6,601	5.37	8,447	4.38	7,531	4.37
Cook	1,238	1.01	5,225	2.71	7,050	4.09
Plumber	5,679	4.62	7,662	3.97	6,489	3.77
Welder	3,411	2.78	4,337	2.25	6,382	3.70
Steamfitter-Pipefitter	7,253	5.90	9,849	5.10	6,355	3.69
Industrial Electrician	2,350	1.91	8,947	4.64	5,943	3.45
Heavy Duty Equipment Mechanic	3,636	2.96	4,973	2.58	4,835	2.81
Sheet Metal Worker	4,472	3.64	5,901	3.06	4,426	2.57
Machinist	1,894	1.54	3,728	1.93	4,312	2.50
Heavy Duty Equipment Operator	2,467	2.01	5,314	2.75	4,139	2.40
Motor Vehicle Body Repairer	-	-	3,910	2.03	3,396	1.97
Refrigeration & Air Conditioning Mech.	1,352	1.10	3,086	1.60	3,287	1.91
Truck and Transport Mechanic	-	-	756	0.39	2,764	1.60
Tool and Die Maker	898	0.73	1,945	1.01	2,401	1.39
Painter and Decorator	2,009	1.63	3,543	1.84	2,338	1.36
Plasterer	574	0.47	2,249	1.17	1,811	1.05
Bricklayer	3,086	2.51	3,765	1.95	1,802	1.05
Industrial Instrument Mech.	473	0.38	1,638	0.85	1,731	1.00
Roofer	722	0.59	1,939	1.00	1,718	1.00
Ironworker	1,474	1.20	2,576	1.34	1,680	0.97
Landscape Gardener	126	0.10	971	0.50	1,405	0.82
Top 25 trades	106,313	86.50	166,020	86.04	146,673	85.11
Other trades	16,595	13.50	26,926	13.96	25,670	14.89
Total	122,908	100.00	192,946	100.00	172,343	100.00

Source: Appendix Table A2 based on Statistics Canada/HRDC apprenticeship data base.

Construction trades, defined to include 12 of the most important 25 trades (construction electrician, carpenter, plumber, welder, steamfitter-pipefitter, sheet metal worker, heavy duty equipment operator, painter and decorator, plasterer, bricklayer, roofer, and ironworker) accounted for 51.5 per cent of total registrations in 1997. This was down from 59.4 per cent in 1991 and 64.2 per cent in 1997 as apprenticeship registrations in non-construction trades have outpaced those in construction trades.

This trend in illustrated by an examination of growth rates in apprenticeship registrations by trades. Between 1977 and 1997, the trades with the fastest growth (see Appendix Table A4) were landscape gardening (12.8 per cent per year), followed by cook (9.1 per cent), industrial instrument mechanic (6.7 per cent), plasterer (5.6 per cent), hairdresser (5.6 per cent) and tool and die maker (5.0 per cent). Trades with declines in total apprenticeship registrations over the 1977-97 period were sheet metal workers, steamfitter-pipefitter, and bricklayer.

The apprenticeship system has not expanded beyond its traditional occupations into occupations in such fields as arts, business and commerce, health sciences, natural sciences, and social sciences in recent years. It has been particularly weak in emerging occupations associated with information technologies. This heavy concentration of apprenticeship enrolments in traditional occupations is true for all provinces.

Apprenticeship by gender

The apprenticeship system has historically been heavily male-dominated and this trait continues to be true. For example, in 1995-96, women represented only 3.6 per cent of persons enrolled in apprenticeship programs in Canada (Chart 6). Despite the wide recognition of this problem, the proportion of women registered in apprenticeship programs has not significantly increased in recent years.

There is considerable variation in the relative importance of women enrolled in apprenticeship programs by province, reflecting provincial differences in the mix of apprenticeship programs offered (some apprenticeship programs such as hairdressing are female-dominated and may be of greater relative importance in certain provinces), and possibly differences in attitudes to women entering apprenticeship programs. By province, the share of women in apprenticeship enrolment ranged from a high of 7.4 per cent in Newfoundland to a low of 1.7 per cent in Manitoba (Chart 6).

Age structure of apprentices

Table 7 shows the distribution of apprenticeship registrations for all trades by age group for Canada for 1991 and 1996. In 1991, 15.7 per cent of apprentices were 22 or under, 51.5 per cent in the 23-30 age group, 23.9 per cent in the 31-39 age group, and 9.0 per cent 40 and over. By 1996, the proportion in the 22 and under age group had fallen to 11.5 per cent, and that in the 23-30 age group to 44.7 per cent. In contrast, the proportion in the two older age groups (31-39 and 40 and over) had risen to 30.0 per cent and 13.8 per cent respectively. This tilt toward an older age structure resulted in an increase in the average age of those registered in apprenticeship programs by almost 2 years from 29.1 years in 1991 to 30.9 years in 1996 (Table 8).

Chart 5: Woman Enrolment in Apprenticeship Programs by Province, 1995-96

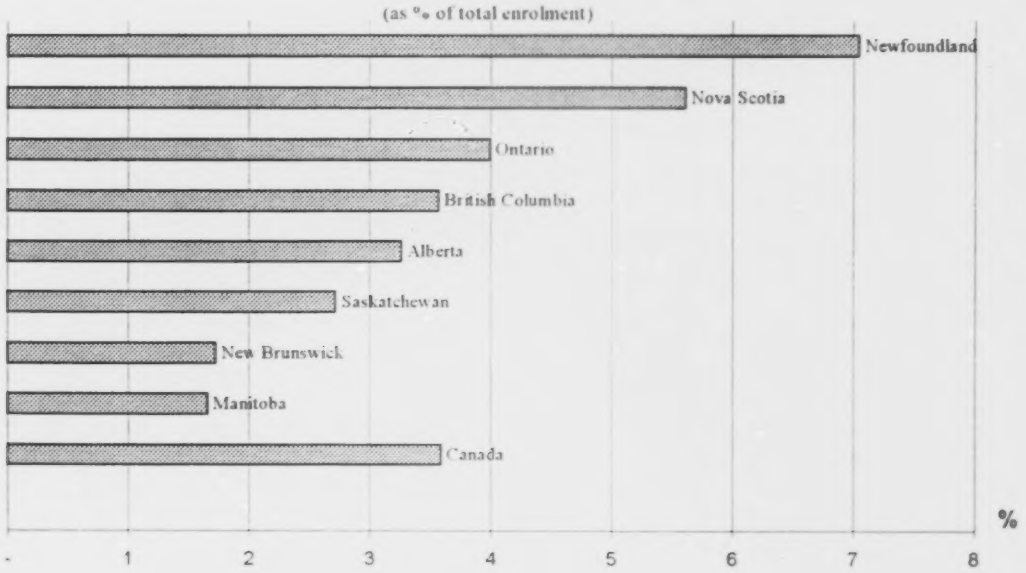


Chart 6: Apprenticeship Completion Rates

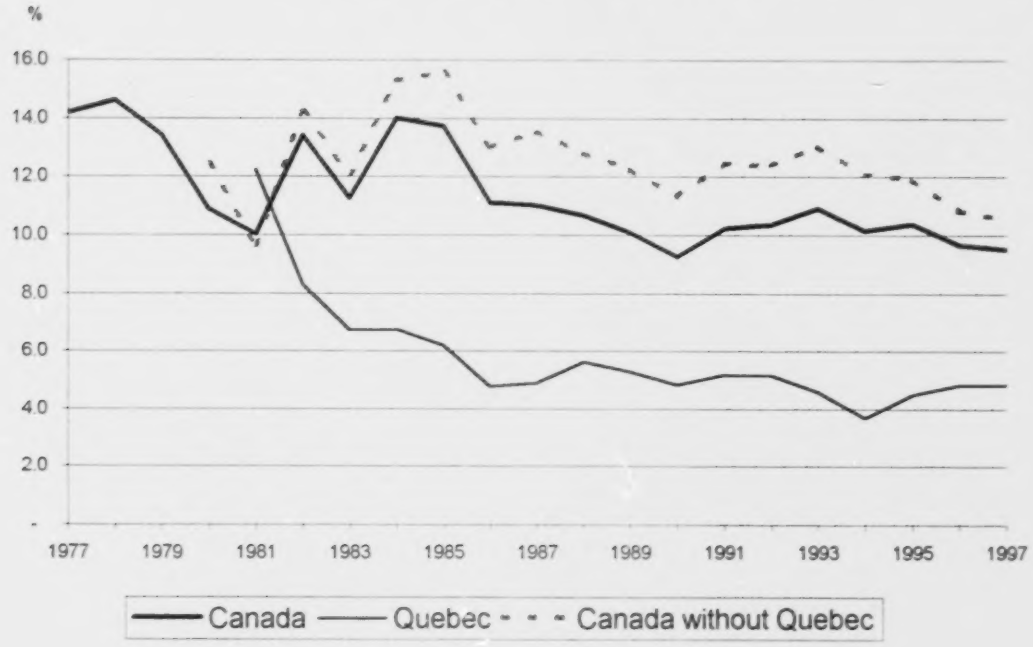


Table 7

The Age Structure of Apprentices
(% of apprentices registrations at start of period)

	1991	1996
22 or less	15.7	11.5
23-30	51.5	44.7
31-39	23.9	30.0
40+	9.0	13.8

Source: Statistics Canada-HRDC Apprenticeship database

Table 8
The Average Age of Apprentices

	Registrations (at start of period)	New Registrations	Completions
1991	29.1	27.8	29.2
1992	29.4	28.3	29.4
1993	29.8	27.9	30.0
1994	30.3	27.6	29.7
1995	30.6	28.1	30.1
1996	30.9	28.0	30.4

Source: Statistics Canada-HRDC Apprenticeship database

This aging of apprentices may reflect a number of factors: the overall aging of the population; the increasing propensity of older persons to pursuit training or retraining; and a lengthening of the time needed to complete apprenticeship programs. The fact that the average age of new apprenticeship registrations rose only 0.2 years from 27.8 years in 1991 to 28.0 years in 1996 suggests that the average number of years spent in an apprenticeship program has increased significantly. Indeed, like the average age of registrations at the start of the period, the average age of completions has increased, up 1.2 years from 29.2 years to 30.4 years from 1991 to 1996.

Apprenticeship completion rates

While total apprenticeship registrations have kept pace with labour force growth, the same cannot be said for the number of apprentices successfully completing apprenticeship programs. Indeed, the number of completions in 1997 (16,383) was below that of 1977 (17,429) despite the 40 per cent increase in the size of the labour force and 40.2 per cent increase in total apprenticeship registrations over the period (Table 1). But it is completion rates, not the absolute number of completions that are relevant to an examination of the effectiveness of the apprenticeship system.

The completion rate is defined as the ratio of total registrations in a year (registrations at the start of a year and new registrations) to the number of completions of apprenticeship programs[2]. This is the definition of completion rate used by Statistics Canada.

In a situation where the number of new registrations constant, there are no withdrawals or discontinuations, and all registrants finishing the program in the normal number of years, the completion rate will be the reciprocal of the number of years of the program. Thus, if the program is 4 years and the normal completion rate will be 25 per cent. An example illustrates this. Assume 100 persons register and complete the program each year so at any one time there are 400 persons in the program (registrations at the beginning of the period (300 comprising the second, third, and fourth year registrants) and new registrations (100 first year registrants)) The completion rate is calculated at 100/400 or 25 per cent.

The normal completion rate will be less than the reciprocal of the number of the years in the program if there are withdrawals and if persons remain in the program for more than the normal length. If addition, in the case where is population growth or decline, completion rates will be affected. An increase in registrations over time will reduce the completion rate while a reduction in registrations increases the rate.

It is important to note that the completion rate methodology developed above differs significantly from that used to track a cohort which enters a program in a given year. In this case the potential completion rate can be 1 and not the reciprocal of the years of the program since all persons who end could in theory complete the program in the normal number of years. There is no doubt that the cohort methodology is superior to the mechanical methodology used here to calculate completion rates, which represents the rate of throughput of the training system. Unfortunately, there are few cohort tracking studies of the Canadian apprenticeship system (one study of the Alberta apprenticeship system found that in the last two years the completion rate has been between 73 and 74 per cent with the majority completing at the earliest possible completion date).

[2] Completion rates can be calculated in three ways: 1) the ratio of completions in a year to registrations at the start of the year; 2) the ratio of completions to total registrations in a year (the sum of registrations at the beginning of the year and new registrations); and 3) the ratio of completions to registrations at the end of the year (the sum of registrations at the start of the year and new registrations minus discontinuations and completions). When new registrations are positive, the completion rate from method 2 will be less than method 1. When discontinuations and completions are positive, method 3 will always be greater than method 2. An algebraic exposition of the three definitions is given below.

C= completions
Rb= registrations at the beginning of the period
NR= new registrations
Re= registrations at the end of the period
D= discontinuations
C1= C/Rb
C2= C/(Rb+NR)
C3= C/Re= C/(Rb+NR)-(D+C)
If NR>0, then C1>C2
If D+C>0, then C3>C2
If D+C > Rb+NR, then C3>C1

The advantage of the methodology used in this study to calculate completion rates is that since it uses administrative data on apprenticeship registrations, completion rates can be calculated by province and by trade for long periods of time.

The average completion rate, based on the definition developed above, was 9.5 per cent in Canada in 1997, about two fifths of what one might consider the normal completion rate for a four-year apprenticeship program. In addition, the completion rate is on a downward trend, falling one third from 14.2 per cent in 1977 to its current level of 9.5 per cent.

The declining completion rate is largely explained by the many apprentices who drop out of or "discontinue" apprenticeship program before completion. Indeed, the number of discontinuations has risen 39.2 per cent (in line with total registrations) between 1977 and 1997, so that the ratio of completions to discontinuations has risen from 1.45 in 1977 to 2.43 in 1997. In other words, for every apprentice who completes his or her apprenticeship program, around two and one half drop out. An increase in the average length of time apprentices take to complete their programs also accounts for some of the fall in the completion rate.

The completion rate varies greatly by trade (Table 9 and Chart 7). By far the highest completion rate among the 25 largest trades in 1997 was for barbers and hairdressers at 19.9 per cent. All other trades had completion rates of 12 per cent or below. Three trades had apprenticeship completion rates below 5 per cent: painters and decorators (8.7 per cent), landscape gardener (4.8 per cent) and plasterer (1.8 per cent)

Almost all trades experienced a decline in apprenticeship completion rates (see Table 9 and Chart 8) between 1977 and 1997 (the only exception was plumbers, up 2.6 percentage points). Trades experiencing particularly large declines in completion rates (at least 10 points) were plasterers (-16.4 points), industrial instrument mechanics (-12.8 points), heavy duty mechanic (-11.2 points), roofer (-11.0 points), heavy duty equipment operator (-10.8 points), and welder (-10.4 points).

The completion rate varied greatly by province (Chart 9). In 1997, it was lowest in Quebec at 5.9 per cent and highest in British Columbia at 15 per cent, followed by Alberta at 12.5 per cent, and New Brunswick at 11.7 per cent.

Apprentices may sit the IPS certification (red seal) exams when they complete their programs. These exams allow apprentices to work in other provinces. In 1997, 52.0 per cent of those that completed apprenticeship programs received a red seal certificate (Table 1). This is up from the 40 per cent average of the 1986-88 period, but down from the 80 per cent rate of the late 1970s.

Table 9

Apprenticeship Completion Rates by Trade

(% of total registrations)

	1977	1997	Change 77-97 (perc. Points)
Hairdresser	22.84	19.89	-2.96
Plumber	9.79	12.39	2.60
Refrigeration & Air Conditioning Mech.	13.31	11.29	-2.03
Industrial Instrument Mech.	23.89	11.09	-12.80
Welder	21.25	10.91	-10.35
Automotive Service Technician	14.61	10.36	-4.25
Industrial Mechanic (millwright)	16.18	9.91	-6.27
Sheet Metal Worker	12.10	9.78	-2.31
Heavy Duty Equipment Mechanic	20.74	9.53	-11.20
Construction Electrician	13.01	9.53	-3.48
Tool and Die Maker	13.92	9.08	-4.84
Motor Vehicle Body Repairer	-	8.66	-
Machinist	16.10	8.35	-7.75
Cook	12.84	8.30	-4.55
Truck and Transport Mechanic	-	8.25	-
Ironworker	15.20	6.96	-8.23
Roofer	17.73	6.75	-10.98
Industrial Electrician	21.11	6.66	-14.45
Bricklayer	8.68	6.49	-2.19
Steamfitter-Pipefitter	12.66	6.40	-6.25
Carpenter	11.89	5.53	-6.36
Heavy Duty Equipment Operator	16.17	5.44	-10.74
Painter and Decorator	8.66	4.92	-3.74
Landscape Gardener	18.25	4.84	-13.41
Plasterer	18.12	1.77	-16.35
All Trades	14.18	9.51	-4.67

Source: Appendix Table A2 based on the Statistics Canada-HRDC Apprenticeship database.

Chart 7: Apprenticeship Completion Rates by Trade, 1997

(as % of registration at start of period)

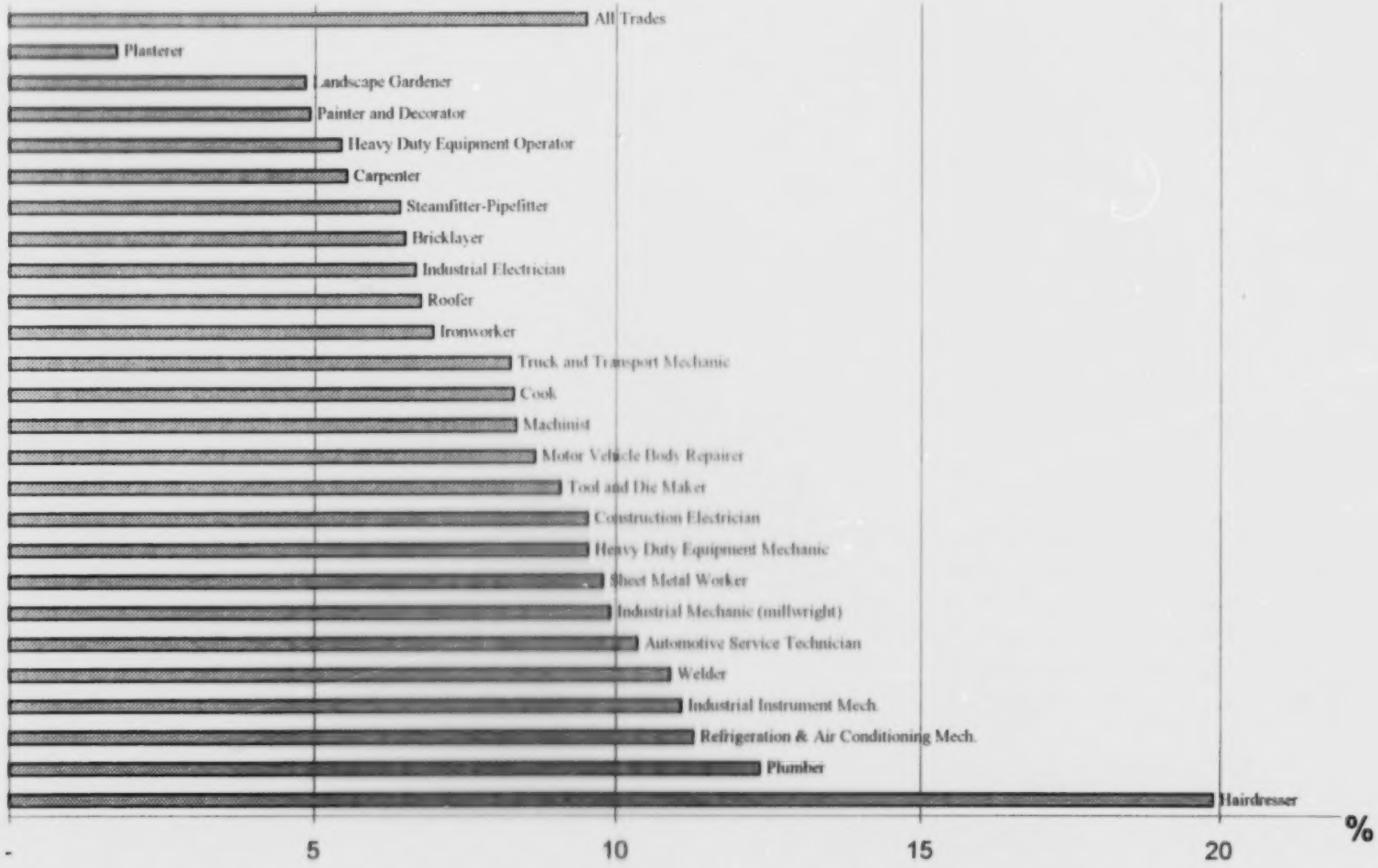


Chart 8: Apprenticeship Completion Rates by trade, Change 77-97, (percentage points)

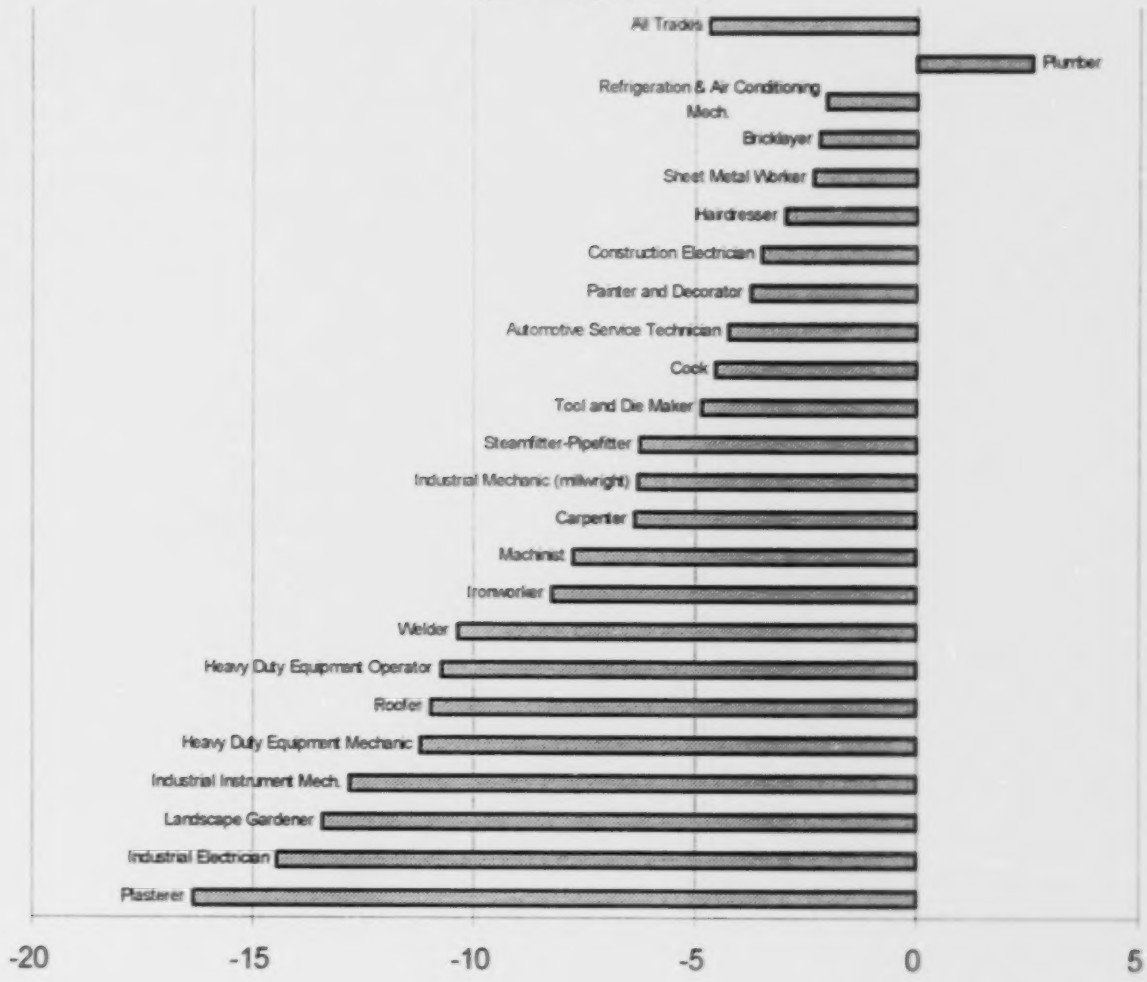


Chart 9: Apprenticeship Completion Rate by Province, 1997

(as % of total registration)

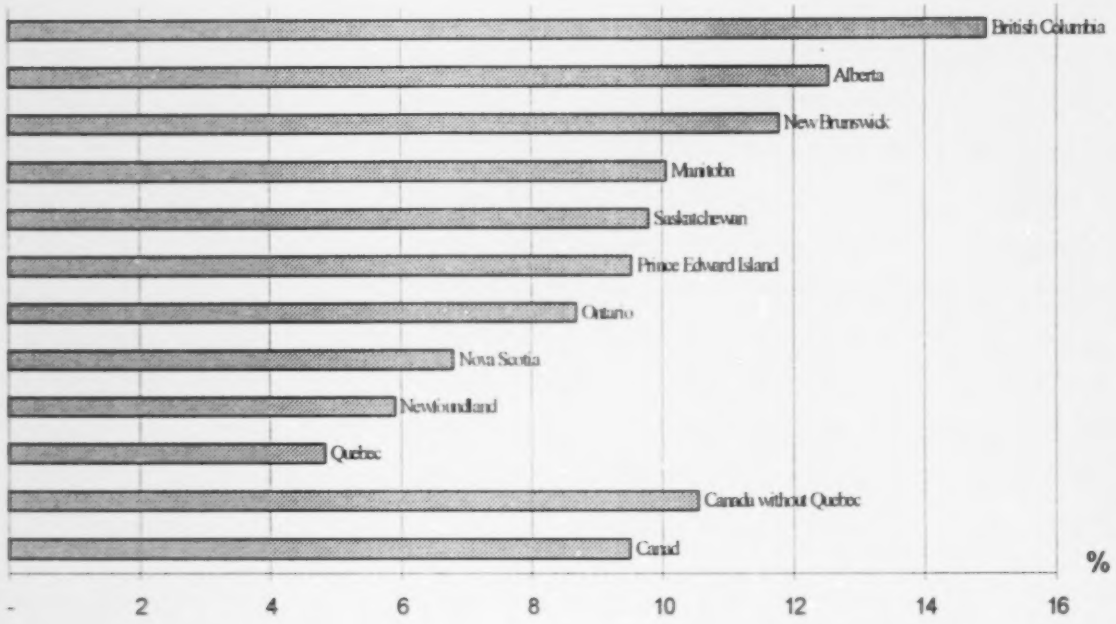


Chart 10: Enrolment Trends in Post-secondary Education in Canada, 1978/79 - 1996/97

(total per cent change)

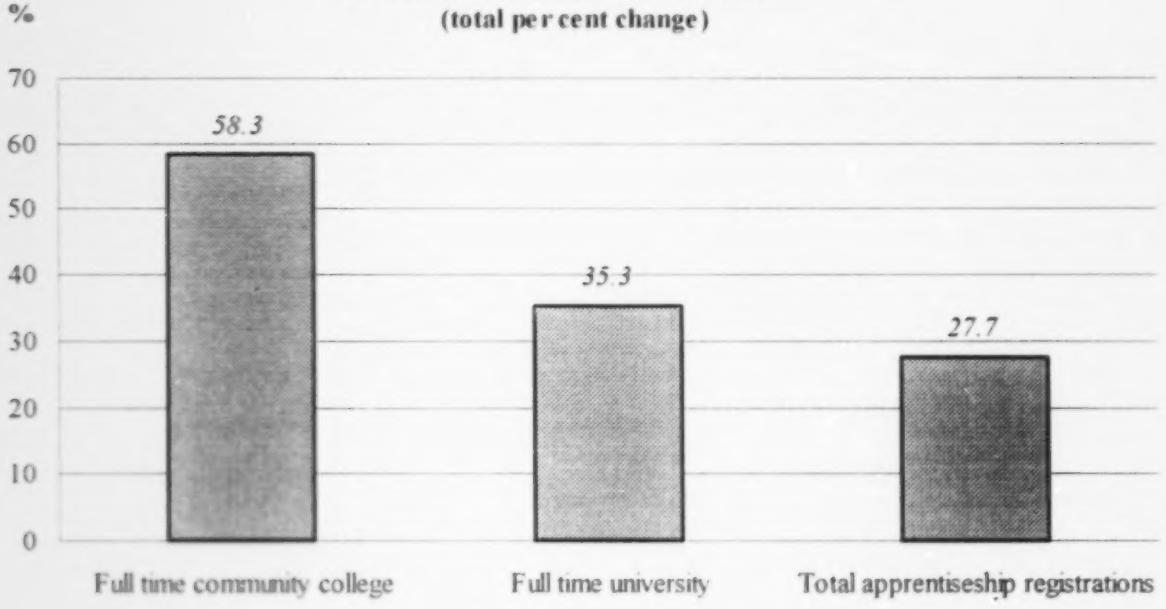


Table 10: Completion Rates by Province, by Type of Post-Secondary Education, 1996-1997.

	Apprent.	Community Colleges			University-Undergraduate			University-Graduate		
	Compl. Rate, %	Total Enrolment	Diplomas	Compl. Rate, %	Total Enrolment	Undergrad. Degrees, Diplomas and Certificates	Compl. Rate, %	Total Enrolment	Graduate Degrees, Diplomas and Certificates	Compl. Rate, %
Canada	9.51	549,062	100,978	18.39	712,958	150,282	21.08	116,810	27,834	23.83
Newfoundland	5.92	5,811	1,796	30.91	14,093	2,634	18.69	1,961	273	13.92
PEI	9.54	1,419	692	48.77	2,699	518	19.19	38	10	26.32
NS	6.81	7,243	3,692	50.97	33,211	6,667	20.07	3,624	1,061	29.28
NB	11.78	4,978	1,287	25.85	22,046	3,963	17.98	1,583	465	29.37
Quebec	4.84	177,867	36,774	20.67	191,311	46,623	24.37	44,382	9,633	21.70
Ontario	8.69	219,876	38,372	17.45	268,799	57,068	21.23	38,034	10,595	27.86
Manitoba	10.06	5,757	1,496	25.99	28,597	5,365	18.76	3,458	667	19.29
Saskatchewan	9.79	3,322	1,431	43.08	28,248	5,053	17.89	3,071	663	21.59
Alberta	12.54	43,330	8,212	18.95	61,322	10,400	16.96	8,712	1,841	21.13
BC	14.93	75,220	6,995	9.30	62,632	11,991	19.15	11,947	2,626	21.98

Source: Statistics Canada/HRDC Apprenticeship Database. August 1999; Education in Canada, 1998, Cat no.81-229, Statistics Canada

Notes: Total enrolment equals the sum of full-time and part-time enrolment.
Undergraduate diplomas, degrees and certificates = Undergraduate level diplomas and certificates + Bachelors and first profession degrees. Graduate diplomas, degrees and certificates = Graduate level diplomas and certificates + Master's degrees + Earned Doctorates.
Note: Data for apprenticeship completion rates are given for 1997. The provincial variation in completion rates may reflect differences in program mix and characteristics and should not necessarily be used for interrprovincial comparisons of post-secondary educational program effectiveness.

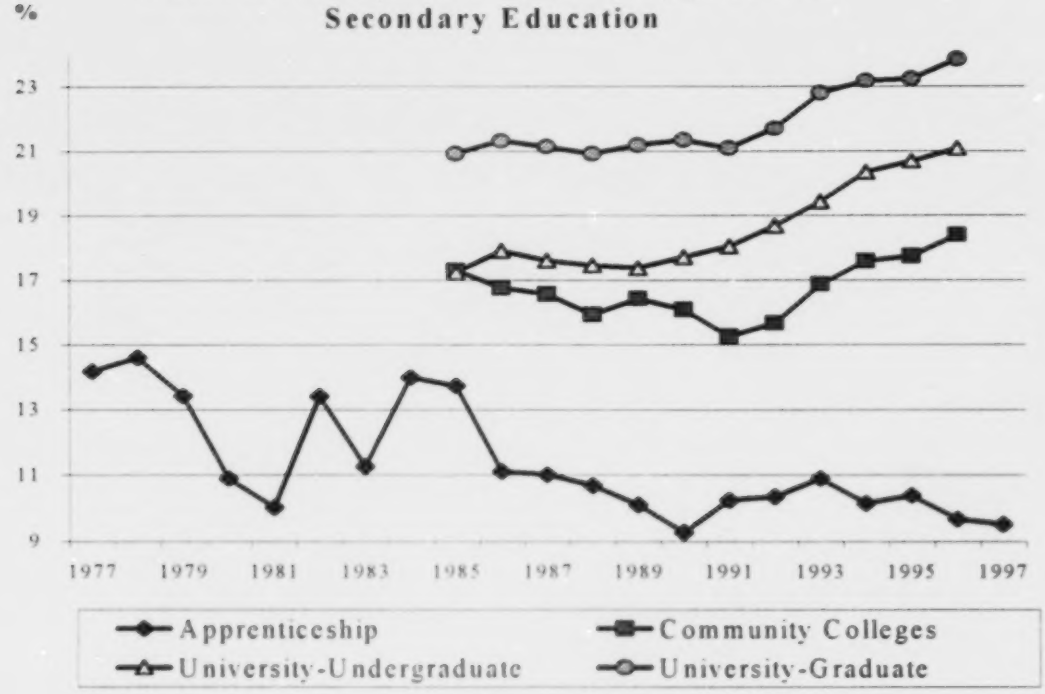
Comparison of Apprenticeship with Other Types of Post-secondary Education

We live in an increasingly knowledge-based economy. Canadians have recognized this reality by greater participation in the different forms of post-secondary education. Full-time community college enrolment has increased 58.3 per cent from 249.8 thousand in 1978-79 to 395.5 thousand in 1996-97 (Chart 10). Full-time university enrolment rose 35.3 per cent from 368.0 thousand in 1978-79 to 498.0 thousand in 1996-97. Private post-secondary educational institutions, including private trainers, have also experienced significant growth in the past two decades, as have cooperative education programs. Among the different types of post-secondary education, apprenticeship programs appear to have experienced the smallest increase over the past two decades, with total registrations in apprenticeship programs increasing only 27.7 per cent per cent between 1978 and 1996.

The completion rate in apprenticeship programs also appear low compared to those in other types of post-secondary education. Applying the methodology used to calculate completion rates in the apprenticeship programs to community college and university enrolment and college diplomas and university degrees reveals much less of a gap between actual and normal completion rates.

Assuming an average length of four years for an apprenticeship program, the normal completion rate would be around 25 per cent, but the actual rate was 9 per cent in 1997, only 36 per cent of what would expect if all apprentices completed their programs. This completion rate was down from 14 per cent in 1977.

Chart 11: Completion Rates by Type of Post-Secondary Education



For a four year undergraduate curriculum, the expected or no-dropout completion rate, defined as the ratio of degrees granted to total enrolment (full-time and part-time) with no dropouts, would be around 25 per cent. In 1996-97, the actual completion rate was 21.0 per cent, double the completion rate of apprenticeship programs and 84 per cent of the rate with no dropouts. (Table 10 and Appendix Table A5). This reflects the fact that the undergraduate drop-out rate appears to be much less than in apprenticeship programs.

The completion rate for graduate programs in 1997 was 23.8 per cent, more than double that for apprenticeship programs. It is difficult to estimate an no-dropout completion rate for graduate programs as their length varies greatly across programs.

Assuming an average length of 3 years for community college programs, the no-dropout completion rate for community college students, again defined as the ratio of full-time equivalent enrolment to diplomas, would be expected to be 33 per cent. In 1997, it was 18.4 per cent, about 55 per cent of the expected rate with no dropouts.

Chart 11 and Appendix Table A5 show that the completion rates of undergraduate and graduate university programs and community college programs have risen over time,

in contrast to the decline in completion rates for apprenticeship programs. From 1985 to 1996 the completion rate of community college students rose 1.1 percentage points, for university graduate programs 2.9 points, and for university undergraduate programs rose 3.9 points. Over the same period, the completion rate for apprenticeships fell 4.0 points.

Table 10 shows completion rates for community college programs, undergraduate and graduate university programs, and apprenticeship programs by province. As at the national level, the apprenticeship completion rate is well below that of the other types of post-secondary education in all provinces[3].

Overall Perspective on the Apprenticeship System

The portrait outlined above of Canada's apprenticeship system reveals a number of characteristics that may have a negative impact on the ability of the system to produce the skilled workforce needed by employers. These weaknesses include:

- the stagnation in new apprenticeship registrations in the 1990s. This situation lies in stark contrast to increased enrolment rates in other educational programs and institutions such as community colleges, universities, private training institutions, and cooperative education programs;

- the inability of the apprenticeship system to expand beyond traditional fields such as the construction trades and motor vehicle repair into growing occupations in business and commerce, health sciences, natural sciences, and social sciences;

- the inability of the apprenticeship system to increase the extremely low proportion of women enrolled in apprenticeship programs (3 per cent);

- the uneven development of apprenticeship programs by province, resulting in regional disparities in access to apprenticeship programs;

- the very low level of completion rates for apprenticeship programs (9.5 per cent) due to the high drop out rate. This completion rate is much lower than in other types of education and training; and

- the strong downward trend in apprenticeship completion rates, declining one third over the past two decades.

[3] The only exception is the completion rate for community colleges in British Columbia. This situation may reflect the fact the community college students in this province can transfer to university programs so do not show up as graduates of community college programs.

II Demand Conditions for Apprenticeship Trades

The degree to which the apprenticeship system can meet the requirements of the labour market depends on the overall state of demand in the economy. If demand for skilled workers is weak, the inadequacies and inefficiencies of the apprenticeship system will not be particularly important as the labour market will be demand-constrained, not supply-constrained, as it has been so far in the 1990s. The weaknesses of the apprenticeship system will not come to light. If, on the other hand, labour demand is strong in the future, then an inability of the apprenticeship system to supply the labour market with an adequate supply of well qualified workers will mean that supply-side limits on production will be reached sooner than if the system were functioning well.

This part of the paper looks at projections for future labour demand to identify the likelihood that shortages will emerge. The focus will be on the total economy and on the construction sector as the lion's share of apprentices are in this sector.

Trends in the first half of the 1990s

As is well know, aggregate demand growth in Canada in the 1990s was been very weak by historical standards,[4] with output growth rising at a 1.3 per cent average annual rate from the 1989 cyclical peak to 1995 (see Table 10). This compares with an average annual growth rate of 3.2 per cent in the 1980s, 3.9 per cent from 1973 to 1981, and 4.8 per cent from 1961 to 1973. Employment growth and output per worker growth have also been weak, averaging in the first half of the 1990s less than one half their rate of growth in the 1980s.

Output in the construction industry plummeted in the first half of the 1990s, falling at a rate of 3.3 per cent between the 1989 peak and the 1995 trough. Employment fell at a slower pace than output (2.2 per cent per year), with the result that output per worker fell at a 1.1 per cent average annual rate.

[4] Pierre Fortin (1996) argues that the poor economic growth in the 1990s has been the result of high interest rates in the early 1990s caused by the Bank of Canada over zealous pursuit of price stability. For a defense of the Bank of Canada's actions and competing explanations of the slump, see Freedman and Macklem (1998).

Table 11

Trends in Output, Employment, and Output Per Worker in the Total Economy and Construction (average annual rate of change)

	1981-89	1989-95	1995-99
Total Economy			
Real Output	3.2	1.3	3.0
Employment	1.7	0.5	2.2
Output Per Worker	1.5	0.8	0.8
Construction Sector			
Real Output	1.7	-3.3	3.8
Employment	2.4	-2.0	2.3
Output Per Worker	-0.7	1.3	1.4

Source: National Accounts and Labour Force Survey, Statistics Canada

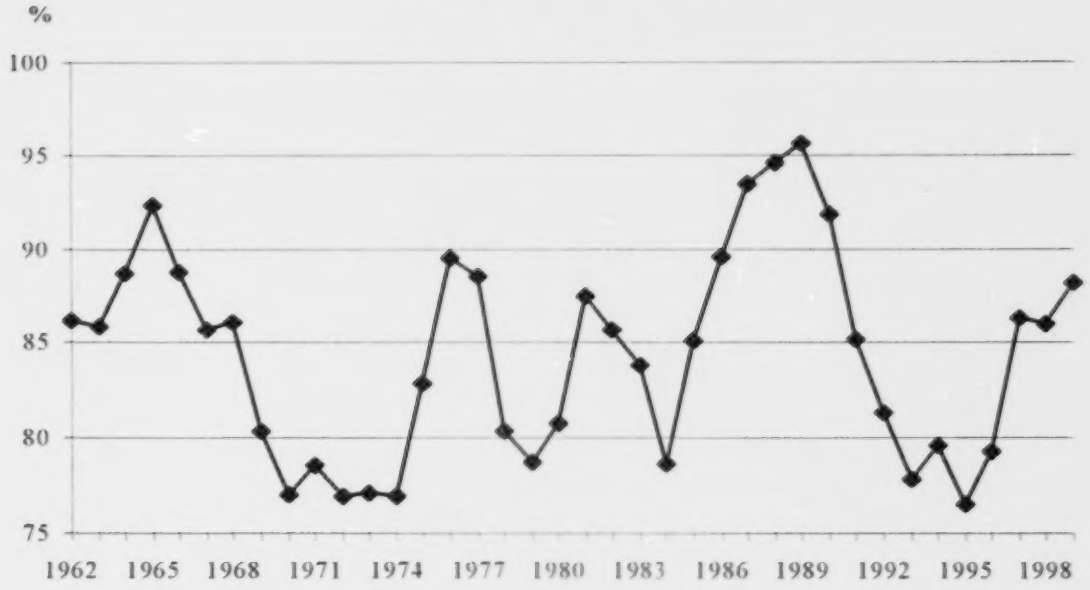
Note: Data for 1999 estimates based on first 11 months employment data and first three quarters output data.

Capacity utilization in the construction sector peaked at 95.6 per cent in 1989, a record high (Chart 12). By 1995, it bottomed out at 76.5 per cent. Equally, the unemployment rate in construction rose from 11.7 per cent in 1989 to a peak of 20.4 per cent in 1991 and by 1995 was still 15.7 per cent (see Table A5 in the appendix). The utilization rate of construction labour, which relates the actual hours worked by the construction labour force to the potential hours that could be worked, followed quite closely trends in the unemployment rate of construction workers, peaking at 88.5 per cent in 1989, reaching a trough of 74.8 per cent in 1992, and then recovering to 81.0 per cent by 1995 (see Table A5 in the appendix).

Scenarios for Canada for 1995-2005

Human Resources Development Canada is currently supporting the work of a number of Industrial Adjustment Committees for the construction trades. Committees have been established for the following trades: boilermakers and millwrights, carpentry, electrical trades, iron workers, labourers, operating engineers, piping trades, and

Chart 12: Capacity Utilization Rate in the Construction Sector, Canada 1962-99



sheetmetal workers and roofers.[5] The mandate of these committees is to develop a "road map" for labour force development in the construction sector over the next decade by addressing such issues as future employment requirements, the supply of workers, and the training needs of the construction workforce.

In March 1996, members of the various IAS construction trades committees came together to develop scenarios of the Canadian construction industry. Out of the discussion at the workshop, the economic forecasting firm Informetrica (1996) developed an optimistic "Orange" scenario and a pessimistic "Brown" scenario for the total economy and the construction industry, with projections for the second half of the 1990s (1995-2000) and the first five years of the next decade (2000-2005).

The scenarios are based on assumptions for nine factors determining the state of the construction labour market: interest rates, resource development, business and consumer confidence, rest-of-world growth, debts and deficits, construction productivity, immigration, government infrastructure spending, and productivity in other sectors. The assumptions are summarized in Table 12.

[5] Final reports are now available for construction labourers (O'Grady Consulting, 1997), operating engineers (Dalcor, 1997), and pipe trades (ARA Consulting, 1997).

Table 12

Assumptions on Driving Forces for Construction Scenarios
(assumptions made in April, 1996)

Driving Force	Optimistic Scenario	Pessimistic Scenario
Interest rates	declining 6 per cent mortgage rate in 2005	remain high and rise 9.5 per cent mortgage rate in 2005
Resource development	strong 22-23 billion (86$) in 2005	weak 15-16 billion ($86) in 2005
Business and Consumer Confidence	rising 15 % above reference forecast in 2005	weak 10 % below reference forecast in 2005
Rest-of-world growth	strong (4 % per year)	slow (2% per year)
Debts and Deficits	falling (-1 % of GDP for total government debt)	rising (+1 % of GDP for total govt. debt)
Construction productivity	2 % per year increase in output per worker in construction sector	same
Immigration	steady 200 thousand per year	declining 100 thousand per year
Govt. Infrastructure	rising $9 billion (86$) in 2005	little change $8 bill.($86) in 2005
Productivity in Other Sectors	rising, 2 % annual increase in output per worker	weak, 0.5 % annual increase in output per worker

Informetrica *Planning for Uncertain Times: Canada's Economy and the Construction Industry, Final Report*, prepared for Human Resources Development Canada, April, 1996.

Table 13

Scenarios for the Total Economy for Canada, 1995-2005
(average annual rate of change)

	1995-2000		2000-2005		1995-2005	
	Opt.	Pess.	Opt.	Pess.	Opt.	Pess.
			Total Economy			
Real Output	3.3	1.4	3.1	1.6	3.2	1.5
Employment	1.7	0.7	1.1	1.0	1.4	0.9
Output Per worker	1.6	0.7	2.0	0.6	1.8	0.6
			Construction			
Real Output	4.4	0.2	2.4	1.5	3.4	0.9
Employment	2.5	-1.6	0.2	-0.7	1.4	-1.0
Output per Worker	1.9	1.8	2.2	2.2	2.0	1.9

Source: Informetrica (1996) *Planning for Uncertain Times: Canada's Economy and the Construction Industry, Final Report*, prepared for Human Resources Development Canada, April.

In the optimistic scenario, the total economy advances at a 3.3 per cent annual rate over the 1995-2000 period and at 3.1 per cent in 2000-2005 (see Table 12). This is well above the 1.3 per cent annual growth in the first half of the 1990s. In the pessimistic scenario, output increases at only a 1.4 per cent annual rate in 1995-2000 and 1.6 per cent in 2000-2005, a rate comparable to that experienced in the first half of the 1990s.

Employment growth is higher in the optimistic scenario than in the pessimistic scenario in the 1995-2000 period: 1.7 per cent versus 0.7 per cent. Productivity growth is also higher in the optimistic scenario. Employment growth is virtually identical at 1.0-1.1 per cent in the two scenarios in the 2000-2005 period. With stronger output growth and similar employment growth, the optimistic scenario produces much higher productivity growth in the 2000-2005: 2.0 per cent versus 0.6 per cent.

For the construction sector, the optimistic scenario, not surprisingly, sees much stronger output growth than the pessimistic scenario in the 1995-2000 period: 4.4 versus 0.2 per cent. In the 2000-2005 period, there is much less difference between the growth rates in the two scenarios: 2.4 per cent versus 1.5 per cent.

The faster output growth in the optimistic scenarios means that employment growth is also greater in this scenario than in the pessimistic scenario (2.5 per cent versus −1.6 per cent in 1995-2000 and 0.2 per cent versus −0.7 per cent in 2000-2005). This is not true for productivity growth, which in almost identical in both scenarios (1.9 per cent versus 1.8 per cent in 1995-2000, and 2.2 per cent in 2000-2005.

The failure of stronger output growth to increase productivity growth arises from the assumption that productivity is largely determined by technology and is not sensitive to the underlying economic conditions. This has not been the case in the past as seen by the variability of productivity in different periods and by the fact that investment in machinery and equipment affects productivity and is sensitive to the state of the economy. In addition, technology improvements in the construction sector at a pace superior to that enjoyed in the past is seen as leading to more rapid productivity growth

Comparison of 1995-2000 Scenarios with 1995-99 Trends

Data are currently available up to the third quarter of 1999 for output and November 1999 for employment so it is possible to see which scenario for 1995-2000 best corresponds to the actual data for the first four years of the period (see Table 10).

For the total economy, output rose at a 3.0 per cent average annual rate over the 1995-99 period, very close to the optimistic scenario of 3.3 per cent. Employment growth in 1995-98 was 2.2 per cent per year, even higher than the 1.7 percent projected in the optimistic scenario. Consequently, with actual output growth slightly slower and employment growth faster than projected in the optimistic scenario, actual productivity growth has been slower than projected (0.8 per cent versus 1.6 per cent).

Of course, caution should be exercised in these comparisons. It may be potentially misleading to compare the actual trends from a four-year period with the projections for a five-year period when anything can happen in the final year of the period. However, there is a high probability that the results for the 1995-2000 period will not differ greatly from that of the 1995-99 period given that 80 per cent of the numbers are in.

For the construction sector, the optimistic scenario also appears to be taking place. Output growth has averaged 3.8 per cent per year over the 1995-99 period, somewhat below the optimistic projection of 4.4 per cent for 1995-2000. Actual employment growth has been close to that projected in the optimistic scenario (2.3 per cent versus 2.5 per cent). Consequently, actual productivity growth in 1995-99 has been below the rate projected in the optimistic scenario for 1995-2000: 1.4 per cent versus 1.9 per cent per year.

Provincial Scenarios

Informetrica has also produced projections for the optimistic and pessimistic scenarios by province for total economy output (Table A5 in the appendix) and for output and employment in the construction industry (Table A6 in the appendix).

For the total economy, in 1995-2000 and in 2000-2005, both scenarios show Newfoundland and Ontario with the strongest output growth. Prince Edward Island and Nova Scotia have the lowest output growth in 1995-2000 in both scenarios and in the Orange scenario in 2000-2005.

For the construction sector, Prince Edward Island has the weakest output growth in both scenarios in 1995-2000 with the winding down of the Fixed Link project.

Newfoundland was the second weakest growth. In contrast, Alberta is projected to have the strongest output growth in both scenarios, although there is a major difference in growth between scenarios (7.0 per cent versus 1.3 per cent). In 2000-2005, Newfoundland has the weakest output growth in the optimistic scenario and Quebec in the pessimistic scenario, while New Brunswick has the fastest output growth in both scenarios.

It is of course projected employment growth than is important for assessing the ability of the apprentice system to furnish an adequate supply of workers. Alberta is projected to have the greatest increase in demand for construction workers in 1995-2000 at 5.0 per cent per year in the optimistic scenario. All other provinces are far behind this rate of growth in labour requirements. In the pessimistic scenario demand for construction workers falls between 1995 and 2000 in all provinces. In 2000-2005, the majority of provinces have no increase in requirements for construction workers in either scenario. It appears that the demand for constructions workers is not going to be particularly strong to 2005 in any province no matter what scenario emerges.

Occupation Studies of the Construction Labour Market

Human Resources Development Canada has commissioned a large number of studies of labour market trends in construction occupations. It is useful to examine the findings of a number of these studies to gain an appreciation for the uncertainty that underlies labour market projections as well as the large differences in projections of labour requirements between scenarios. All studies use as a reference the optimistic (Orange) and pessimistic (Brown) scenarios developed by Informetrica and apply these scenarios to their particular trade. Key findings from the studies are highlighted below.

- A study by O'Grady (1997) on labourers shows massive differences in labour demand between low growth and high growth scenarios in 1995-2000 for all construction trades and for labourers for all regions (Table A7 in the appendix). For example, changes in labour demand for all construction trades vary in Atlantic Canada from 11 per cent to 43 per cent.

- A study by Dalcor (1997) found major differences in the demand for operating engineer trades and occupations in 2005 between the pessimistic and optimistic scenarios (Table A8 in the appendix). For example, many sub-trades see a 30 per cent difference in labour requirements between scenarios.

- A study by ARA Consulting (1997) on the pipe trades found that labour requirements in this sector in 2015 ranged from 78 thousand to 135 thousand depending on the scenario and exit rate assumption (Table A9 in the appendix).

Lessons from labour market projections

A number of lessons can be drawn from the above discussion of future trends in labour requirements in the construction industry.

- Given developments to 1999, it appears that the actual growth path of output, employment, and productivity in the construction sector in the 1995-2000 period will be close to the optimistic scenario.

- No province is projected to experience rapid growth in labour requirements in both scenarios and in both periods. The fastest labour demand growth, and hence the greatest risk of labour shortages, is in Alberta under the optimistic scenario in 1995-2000.

- There appears to be greater variance in labour requirements between scenarios for occupations than for provinces.

III The Apprenticeship System and the Labour Market

This report has provided an overview of the Canadian apprenticeship system, identifying a number of weaknesses. It has also presented projections for output and employment for the total economy and for construction to 2005. This final section briefly discusses the two-way interaction between the apprenticeship system and the labour market. The apprenticeship system supplies the labour market with qualified workers in the apprenticeable trades.[6] Labour market conditions in turn feed back on the apprenticeship system, influencing registrations and the overall development of the system.

The trends described in this paper raise serious questions about the ability of the apprenticeship system in Canada to produce an adequate supply of qualified workers for the economy. As suggested by the title of this paper, the apprenticeship system may be under siege. The stagnation of new apprenticeship registrations in the 1990s, the low and falling completion rates, the failure of the apprenticeship system to expand beyond traditional occupations, the low female participation, and lack of expansion of the real seal program suggest that the apprenticeship system was not adapted well to the current labour market realities. The performance of the apprenticeship system lies in marked contrast to other types of education and training programs, such community college enrolment and cooperative education programs, which have expanded at a more rapid rate.

It is true that new registrations in apprenticeship programs are cyclical in nature, declining when employment opportunities are weak and expanding when they are strong. The weak economy of the 1990s may well have dampened new apprenticeship registrations. Given the strong economy in 1998 and 1999, the data for these years may show large increases in new apprenticeship registrations, following the significant increase in 1997, also a year of robust economic activity. But cyclical increases in apprenticeship registrations will not eliminate or even lessen the structural problems that face the apprenticeship system noted above.

[6] The number of new entrants that a trade will need depends on construction activity, total hours of employment, average annual hours of employment per worker, the unemployment rate, and erosion rates over the forecast period. Inter-provincial and inter-sectoral mobility can also reduce labour needs in particular regions and sectors

When there is weak demand for qualified workers the deficiencies of the apprenticeship system have limited consequences. Since large increases in the number of qualified workers are not needed, the low apprenticeship completion rates do not represent an obstacle to growth. Employers do not put pressure on the apprenticeship system to become more effective. In contrast, strong demand for qualified workers makes employers more aware of the deficiencies of the apprenticeship system and creates demand for reforms.

It is possible, that under certain conditions as found in the optimistic scenario outlined in the second section of the paper, future demand for new entrants in construction trades could be very strong, resulting in shortages given the limited supply of journeypersons who successfully complete apprenticeship programs. If labour demand exceeds labour supply, creating labour shortages, attention will be directed toward the inability of the apprenticeship system to produce an adequate supply of skilled tradespersons.

If external pressure arising from a tight labour market on the apprenticeship system to reform continues to be weak, the impetus to reform the apprenticeship system must come from inside the system.

IV Conclusion

The first version of this paper elicted strong reactions from some members of the apprenticeship community. This is understandable. Apprenticeship training has a long and proud tradition in Canada of supplying the country with critical skills the economy needs, and there is a large group of people dedicated to preserving the best of this tradition. That is precisely why it is important to examine the statistical trends, and be vigilant that apprenticeship remains a viable and effective training system. There is no question that the statistical trends this paper reveals are a cause for concern and do warrant attention.

The perspective one has on the effectiveness of the apprenticeship system depends on a number of factors, including one's province, trade, role in the system, and expectations of what the system can and should deliver in meeting the training needs of Canadians in an effective manner.

For example, apprenticeship registrations are disproportionately high in Alberta and the completion rate is well above the national average, so the system may be working well in this province. But in other provinces, such as Quebec, registrations and completion rates are low. Equally, registrations in certain trades such as landscape gardener and cook are growing rapidly while in others such as bricklayer there are in free fall. Persons intimately involved in the apprenticeship programs may feel the system is working from their perspective, and even feel threatened and defensive when outsiders with little practical knowledge of the apprenticeship system assert the system is a crisis on the basis of a statistical analysis which from the practitioners viewpoint is of little value. On the other hand, persons with comparative knowledge of different education systems may find that the apprenticeship system is not keeping pace relative to other

types of post-secondary education.

Expectations are also crucial in one's evaluation of the apprentice system. If one thinks it is normal that apprenticeship programs have few women registrations because most trades are of intrinsically little interest to women, that the drop-out rate should be more than double the completion rate, and that emerging occupations in the information technology, unlike the traditional trades, are not suited to the apprenticeship model of training, then the status quo is acceptable and there is no crisis, or even serious situation.

On the other hand, if one has the expectations that many women may be interested in working in trades traditionally dominated by men, that high drop-out rates waste both financial and human resources, and that the apprenticeship model may indeed be relevant to new occupations in the emerging sectors, then the status quo is unacceptable and changes are needed.

The conclusion of this study is that the problems facing Canada's apprenticeship system as documented in this paper merit serious attention from all labour market partners. The quality of the workforce is crucial to the health of the economy and expanding and improving the apprenticeship system will increase workers' skills.[7] Key questions that should be addressed include the reasons why Canada's apprenticeship system appears unable to have its apprentices complete their programs in a timely manner, if at all; why the apprenticeship system has not expanded outside traditional occupations; and why women are not attracted to apprenticeship programs.

[7] O'Grady points out that workers' skills may be viewed from two perspectives: Breadth of skills and depth of skills. The former refers to the number of skill sets in which a worker has a moderate degree of competence acquired through experience and demonstrated by use. It is an important determinant of inter-sectoral mobility, which in turn contributes to overall employability. The latter refers to the number of essential and desirable skills that a worker has acquired within a particular skill set. A worker with skill depth is more employable, but only within that sector

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Appendix Table A1: Trends in Apprenticeship by Province

Year	Canada							Canada without Quebec						
	Reg. Start	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*	*Reg. Start*	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*
1980	94,997	43,676	138,673	15,096	9,075	10.89	60.12	86,113	35,397	121,510	n/a	9,075	n/a	n/a
1981	113,408	39,732	153,140	15,340	7,910	10.02	51.56	96,130	34,901	131,031	12,636	7,910	9.64	62.60
1982	125,199	29,926	155,125	20,786	9,011	13.40	43.35	106,679	27,411	134,090	19,043	9,011	14.20	47.32
1983	119,862	19,236	139,098	15,657	8,118	11.26	51.85	102,342	16,314	118,656	14,285	8,118	12.04	56.83
1984	110,598	27,637	138,235	19,335	10,151	13.99	52.50	94,300	22,885	117,185	17,918	10,151	15.29	56.65
1985	101,880	37,319	139,199	19,092	9,093	13.72	47.63	84,022	27,713	111,735	17,396	9,093	15.57	52.27
1986	112,525	41,701	154,226	17,105	6,303	11.09	36.85	88,116	30,522	118,638	15,412	6,303	12.99	40.90
1987	112,253	44,604	156,857	17,258	6,985	11.00	40.47	81,020	29,908	110,928	15,013	6,985	13.53	46.53
1988	123,737	38,327	162,064	17,296	7,675	10.67	44.37	83,944	30,314	114,258	14,610	7,675	12.79	52.53
1989	126,048	48,615	174,663	17,614	9,414	10.08	53.45	86,666	33,473	120,139	14,736	9,414	12.27	63.88
1990	143,894	48,438	192,332	17,804	7,850	9.26	44.09	94,888	36,545	131,433	14,873	7,850	11.32	52.78
1991	160,640	32,306	192,946	19,724	8,588	10.22	43.54	108,837	24,925	133,762	16,660	8,588	12.45	51.55
1992	152,015	28,948	180,963	18,720	8,400	10.34	44.87	149,391	23,008	172,399	18,720	8,395	10.86	44.84
1993	138,359	30,624	168,983	18,411	8,381	10.90	45.52	101,480	24,382	125,862	16,434	8,381	13.06	51.00
1994	133,661	32,007	165,668	16,801	7,134	10.14	42.46	132,265	27,463	159,728	16,801	7,130	10.52	42.44
1995	129,335	35,234	164,569	17,073	7,858	10.37	46.03	100,170	30,055	130,225	15,535	7,858	11.93	50.58
1996	131,875	34,614	166,489	16,092	8,060	9.67	50.09	105,542	28,939	134,481	14,547	8,060	10.82	55.41
1997	132,503	39,840	172,343	16,383	8,522	9.51	52.02	107,105	33,598	140,703	14,852	8,522	10.56	57.38

Source: Statistics Canada HRDC Apprenticeship Database, August 1999.

Year	Newfoundland							Prince Edward Island						
	Reg. Start	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*	*Reg. Start*	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*
1980	2,436	871	3,307	458	347	13.85	75.76	489	109	598	70	68	11.71	97.14
1981	2,574	791	3,365	605	410	17.98	67.77	455	113	568	49	33	8.63	67.35
1982	2,360	614	2,974	537	330	18.06	61.45	454	110	564	49	44	8.69	89.80
1983	2,100	656	2,756	482	287	17.49	59.54	530	125	655	47	36	7.18	76.60
1984	2,125	588	2,713	408	186	15.04	45.59	438	129	567	45	45	7.94	100.00
1985	2,141	591	2,732	348	182	12.74	52.30	474	101	575	51	50	8.87	98.04
1986	2,181	585	2,766	344	157	12.44	45.64	484	133	617	39	39	6.32	100.00
1987	2,103	793	2,896	367	186	12.67	50.68	459	92	551	64	61	11.62	95.31
1988	2,240	825	3,065	339	152	11.06	44.84	328	93	421	51	49	12.11	96.08
1989	2,549	804	3,353	446	201	13.30	45.07	301	102	403	37	34	9.18	91.89
1990	2,572	714	3,286	338	210	10.29	62.13	301	114	415	41	39	9.88	95.12
1991	2,349	479	2,828	354	263	12.52	74.29	324	118	442	46	38	10.41	82.61
1992	2,055	361	2,416	363	279	15.02	76.86	339	88	427	40	39	9.37	97.50
1993	1,818	353	2,171	325	218	14.97	67.08	330	83	413	45	34	10.90	75.56
1994	1,600	444	2,044	240	160	11.74	66.67	308	79	387	51	49	13.18	96.08
1995	1,539	418	1,957	235	191	12.01	81.28	291	120	411	42	27	10.22	64.29
1996	1,463	541	2,004	250	234	12.48	93.60	329	82	411	73	68	17.76	93.15
1997	1,545	1,987	3,532	209	194	5.92	92.82	276	133	409	39	34	9.54	87.18

Year	Nova Scotia							New Brunswick						
	Reg. Start	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*	*Reg. Start*	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*
1980	4,246	1,308	5,554	823	470	14.82	57.11	3,792	1,208	5,000	676	395	13.52	58.43
1981	4,178	1,278	5,456	976	580	17.89	59.43	3,775	1,164	4,939	644	374	13.04	58.07
1982	3,839	1,211	5,050	918	576	18.18	62.75	3,634	934	4,568	621	327	13.59	52.66
1983	3,755	1,132	4,887	673	423	13.77	62.85	3,461	854	4,315	611	409	14.16	66.94
1984	3,788	1,388	5,176	896	440	17.31	49.11	3,356	874	4,230	520	307	12.29	59.04
1985	3,712	1,529	5,241	707	403	13.49	57.00	3,257	930	4,187	494	300	11.80	60.73
1986	3,985	1,288	5,273	650	336	12.33	51.69	3,195	1,050	4,245	395	244	9.31	61.77
1987	4,198	1,170	5,368	610	421	11.36	69.02	3,355	1,172	4,527	480	309	10.60	64.38
1988	4,084	1,069	5,153	550	405	10.67	73.64	3,578	1,471	5,049	541	301	10.71	55.64
1989	4,098	1,112	5,210	565	381	10.84	67.43	3,908	1,522	5,430	507	251	9.34	49.51
1990	3,868	1,137	5,005	621	390	12.41	62.80	4,339	1,389	5,728	523	281	9.13	53.73
1991	4,119	830	4,949	706	459	14.27	65.01	4,690	1,003	5,693	540	326	9.49	60.37
1992	3,880	717	4,597	681	383	14.81	56.24	4,721	910	5,631	622	345	11.05	55.47
1993	3,617	821	4,438	645	276	14.53	42.79	4,508	945	5,453	709	378	13.00	53.31
1994	3,464	739	4,203	460	171	10.94	37.17	4,300	740	5,040	594	297	11.79	50.00
1995	3,268	843	4,111	406	254	9.88	62.56	3,949	774	4,723	610	324	12.92	53.11
1996	3,609	659	4,268	375	314	8.79	83.73	3,605	710	4,315	556	326	12.89	58.63
1997	3,554	705	4,259	290	275	6.81	94.83	3,295	644	3,939	464	267	11.78	57.54

Year	Quebec							Ontario						
	Reg. Start	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*	*Reg. Start*	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*
1980	8,884	8,279	17,163	n.a	-	n.a	n/a	30,570	10,576	41,146	4,653	2,081	11.31	44.72
1981	17,278	4,831	22,109	2,704	-	12.23	-	34,384	11,049	45,433	1,237	169	2.72	13.66
1982	18,520	2,515	21,035	1,743	-	8.29	-	40,823	9,422	50,245	6,726	656	13.39	9.75
1983	17,520	2,922	20,442	1,372	-	6.71	-	39,528	3,326	42,854	2,034	529	4.75	26.01
1984	16,298	4,752	21,050	1,417	-	6.73	-	39,042	9,083	48,125	5,334	1,624	11.08	30.45
1985	17,858	9,606	27,464	1,696	-	6.18	-	36,072	11,380	47,452	5,614	1,545	11.83	27.52
1986	24,409	11,179	35,588	1,693	-	4.76	-	42,040	13,448	55,488	5,332	457	9.61	8.57
1987	31,233	14,696	45,929	2,245	-	4.89	-	35,086	12,310	47,396	5,562	1,469	11.74	26.41
1988	39,793	8,013	47,806	2,686	-	5.62	-	37,729	11,848	49,577	5,807	2,764	11.71	47.60
1989	39,382	15,142	54,524	2,878	-	5.28	-	37,890	13,468	51,358	5,993	3,811	11.67	63.59
1990	49,006	11,893	60,899	2,931	-	4.81	-	43,002	16,042	59,044	6,166	1,757	10.44	28.49
1991	51,803	7,381	59,184	3,064	-	5.18	-	52,601	9,911	62,512	7,276	1,845	11.64	25.36
1992	45,042	5,940	50,982	2,624	-	5.15	-	51,811	8,967	60,778	6,482	1,817	10.67	28.03
1993	36,879	6,242	43,121	1,977	-	4.58	-	48,467	9,199	57,666	6,062	1,598	10.51	26.36
1994	33,337	4,544	37,881	1,396	-	3.69	-	48,642	10,911	59,553	5,814	1,043	9.76	17.94
1995	29,165	5,179	34,344	1,538	-	4.48	-	49,279	12,590	61,869	6,443	1,682	10.41	26.11
1996	26,333	5,675	32,008	1,545	-	4.83	-	52,208	10,940	63,148	5,805	1,691	9.19	29.13
1997	25,398	6,242	31,640	1,531	-	4.84	-	51,817	12,170	63,987	5,560	1,469	8.69	26.42

Year	Manitoba							Saskatchewan						
	Reg. Start	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*	*Reg. Start*	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*
1980	2,861	1,096	3,957	624	541	15.77	86.70	4,843	1,735	6,578	726	607	11.04	83.61
1981	2,903	998	3,901	642	596	16.46	92.83	5,213	1,306	6,519	618	262	9.48	42.39
1982	2,881	815	3,696	617	547	16.69	88.65	5,162	1,026	6,188	582	382	9.41	65.64
1983	2,695	656	3,351	632	578	18.86	91.46	4,800	1,051	5,851	585	424	10.00	72.48
1984	2,498	900	3,398	639	578	18.81	90.45	4,755	1,023	5,778	621	418	10.75	67.31
1985	2,530	1,085	3,615	585	501	16.18	85.64	4,337	841	5,178	530	316	10.24	59.62
1986	2,788	1,441	4,229	481	424	11.37	88.15	4,065	712	4,777	388	329	8.12	84.79
1987	3,338	907	4,245	471	458	11.10	97.24	3,571	723	4,294	432	384	10.06	88.89
1988	3,441	891	4,332	500	445	11.54	89.00	3,404	842	4,246	375	150	8.83	40.00
1989	3,472	887	4,359	519	464	11.91	89.40	3,188	819	4,007	232	192	5.79	82.76
1990	3,200	944	4,144	552	528	13.32	95.65	3,068	1,021	4,089	402	337	9.83	83.83
1991	3,396	744	4,140	740	675	17.87	91.22	3,223	925	4,148	430	368	10.37	85.58
1992	3,399	569	3,968	475	432	11.97	90.95	3,373	1,036	4,409	415	321	9.41	77.35
1993	3,197	495	3,692	410	403	11.11	98.29	3,654	866	4,520	468	258	10.35	55.13
1994	2,364	646	3,010	434	375	14.42	86.41	3,525	887	4,412	384	241	8.70	62.76
1995	2,482	754	3,236	415	378	12.82	91.08	3,631	962	4,593	397	237	8.64	59.70
1996	2,621	776	3,397	391	348	11.51	89.00	3,867	1,202	5,069	370	235	7.30	63.51
1997	2,780	848	3,628	365	340	10.06	93.15	4,295	1,341	5,636	552	480	9.79	86.96

Year	Alberta							British Columbia						
	Reg. Start	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*	*Reg. Start*	*New Registr.*	*Reg. Total*	*Comple-tions*	*Red Seal Certificate*	*Compl. Rate*	*Red Seal Certificate Rate*
1980	22,535	10,517	33,052	4,175	2,927	12.63	70.11	13,798	7,801	21,599	2,728	1,574	12.63	57.70
1981	25,699	9,175	34,874	4,360	3,489	12.50	80.02	16,402	8,830	25,232	3,402	1,917	13.48	56.35
1982	28,157	7,717	35,874	5,184	4,086	14.45	78.82	18,853	5,114	23,967	3,715	1,990	15.50	53.57
1983	27,953	4,603	32,556	5,308	3,154	16.30	59.42	16,864	3,773	20,637	3,819	2,213	18.51	57.95
1984	24,188	4,390	28,578	5,164	3,979	18.07	77.05	13,538	4,348	17,886	4,212	2,515	23.55	59.71
1985	19,975	6,466	26,441	4,665	3,519	17.64	75.43	11,114	4,617	15,731	4,293	2,206	27.29	51.39
1986	19,684	6,716	26,400	4,800	2,865	18.18	59.69	9,338	4,860	14,198	2,915	1,403	20.53	48.13
1987	19,120	6,405	25,525	3,793	2,321	14.86	61.19	9,308	6,058	15,366	3,150	1,334	20.50	42.35
1988	19,034	6,666	25,700	3,480	2,170	13.54	62.36	9,544	6,371	15,915	2,891	1,208	18.17	41.78
1989	19,995	1,583	21,578	3,669	2,715	17.00	74.00	10,684	6,970	17,654	2,680	1,303	15.18	48.62
1990	21,387	8,043	29,430	3,628	2,695	12.33	74.28	12,606	6,845	19,451	2,510	1,562	12.90	62.23
1991	22,913	6,162	29,075	3,886	2,838	13.37	73.03	14,660	4,536	19,196	2,661	1,746	13.86	65.61
1992	22,318	5,358	27,676	3,802	2,606	13.74	68.54	14,482	4,795	19,277	3,119	2,126	16.18	68.16
1993	21,444	6,139	27,583	4,428	2,955	16.05	66.73	13,856	5,307	19,163	3,267	2,217	17.05	67.86
1994	21,135	7,422	28,557	4,444	2,913	15.56	65.55	14,431	5,337	19,768	2,918	1,847	14.76	63.30
1995	21,279	8,057	29,336	4,229	2,712	14.42	64.13	13,884	5,313	19,197	2,686	1,998	13.99	74.39
1996	22,971	7,963	30,934	3,941	2,639	12.74	66.96	14,253	5,837	20,090	2,701	2,144	13.44	79.38
1997	24,455	9,759	34,214	4,290	3,047	12.54	71.03	14,456	5,787	20,243	3,023	2,375	14.93	78.56

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Appendix Table A2 Trends in Apprenticeship by Trade, Canada

	Construction Electrician			Carpenter			Automotive Service Technician			Hairdresser			Industrial Mechanic (millwright)			Cook			Plumber		
Year	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %
1977	19,065	2,481	13.01	18,090	2,150	11.89	16,392	2,395	14.61	3,051	697	22.84	6,601	1,068	16.18	1,238	159	12.84	5,679	556	9.79
1978	19,090	2,744	14.37	18,825	2,302	12.23	17,574	2,678	15.24	3,980	888	22.31	7,295	1,215	16.66	1,468	151	10.29	6,087	662	10.88
1979	18,072	2,722	15.06	18,486	1,790	9.68	18,398	2,499	13.58	4,193	985	23.49	7,533	1,076	14.28	1,708	183	10.71	5,376	497	9.24
1980	17,584	2,107	11.98	17,172	1,446	8.42	18,958	2,240	11.82	3,997	802	20.07	-	-	-	1,885	193	10.24	4,775	290	6.07
1981	18,718	2,116	11.30	19,014	1,930	10.15	19,811	1,524	7.69	4,244	677	15.95	-	-	-	2,113	145	6.86	5,710	575	10.07
1982	18,319	2,383	13.01	18,171	2,174	11.96	20,282	3,091	15.24	4,261	871	20.44	-	-	-	2,610	242	9.27	6,024	648	10.76
1983	16,850	2,057	12.21	16,123	1,546	9.59	17,443	1,692	9.70	4,118	742	18.02	-	-	-	2,933	242	8.25	6,614	449	6.79
1984	16,021	2,476	15.45	15,263	1,648	10.80	18,240	2,461	13.49	4,803	946	19.70	-	-	-	3,611	400	11.08	6,622	544	8.22
1985	15,378	1,978	12.86	16,543	1,790	10.82	17,601	2,385	13.55	5,613	1,332	23.73	-	-	-	4,070	442	10.86	7,074	663	9.37
1986	16,539	1,355	8.19	19,179	1,312	6.84	17,825	1,082	6.07	6,305	1,761	27.93	-	-	-	4,684	297	6.34	7,458	412	5.52
1987	18,163	1,662	9.15	23,790	1,688	7.10	18,112	2,239	12.36	5,999	1,914	31.91	-	-	-	4,897	623	12.72	8,420	453	5.38
1988	19,826	1,752	8.84	24,966	1,601	6.41	18,076	2,190	12.12	5,546	1,602	28.89	-	-	-	4,971	635	12.77	8,828	478	5.41
1989	22,340	1,873	8.38	26,980	1,671	6.19	18,444	2,434	13.20	5,243	1,418	27.05	-	-	-	5,002	718	14.35	9,405	410	4.36
1990	24,041	1,965	8.17	27,529	1,581	5.74	19,485	2,489	12.77	4,671	908	19.44	-	-	-	5,329	655	12.29	9,713	196	2.02
1991	24,605	2,375	9.65	26,889	1,929	7.17	19,611	2,538	12.94	4,154	886	21.33	8,447	1,086	12.86	5,225	635	12.15	7,662	1,025	13.38
1992	23,024	1,999	8.68	25,143	1,881	7.48	18,872	2,521	13.36	4,038	672	16.64	7,646	1,255	16.41	5,067	571	11.27	7,426	894	12.04
1993	21,459	2,296	10.70	23,834	1,781	7.47	17,856	2,271	12.72	4,914	706	14.37	6,195	978	15.79	5,192	536	10.32	7,380	978	13.25
1994	20,907	2,139	10.23	21,631	1,304	6.03	18,127	2,140	11.81	6,339	1,199	18.91	6,367	758	11.91	5,757	556	9.66	7,167	971	13.55
1995	20,238	2,309	11.41	20,024	1,431	7.15	17,616	2,247	12.76	7,279	1,620	22.26	6,507	690	10.60	6,254	587	9.39	6,710	855	12.74
1996	19,591	2,103	10.73	19,410	1,249	6.43	17,113	1,832	10.71	8,179	1,754	21.45	7,033	659	9.37	6,751	564	8.35	5,994	823	13.73
1997	19,771	1,885	9.53	18,688	1,033	5.53	17,368	1,799	10.36	9,051	1,800	19.89	7,531	746	9.91	7,050	585	8.30	6,489	804	12.39

Source: Statistics Canada/HRDC Apprenticeship Database, August 1999.

	Welder			Steamfitter-Pipefitter			Industrial Electrician			Heavy Duty Equipment Mechanic			Sheet Metal Worker			Machinist			Heavy Duty Equipment Operator		
Year	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %
1977	3,411	725	21.25	7,253	918	12.66	2,350	496	21.11	3,636	754	20.74	4,472	541	12.10	1,894	305	16.10	2,467	399	16.17
1978	3,416	701	20.52	7,516	964	12.83	2,275	471	20.70	3,929	716	18.22	4,579	573	12.51	2,288	378	16.52	1,887	310	16.43
1979	3,639	670	18.41	7,747	932	12.03	5,234	710	13.57	4,198	648	15.44	4,610	483	10.48	2,823	306	10.84	1,521	459	30.18
1980	4,455	658	14.77	8,198	1,110	13.54	4,270	370	8.67	5,889	741	12.58	4,683	413	8.82	3,806	317	8.33	746	9	1.21
1981	4,875	693	14.22	8,496	831	9.78	5,475	665	12.15	6,713	732	10.90	5,210	485	9.31	4,381	254	5.80	1,195	152	12.72
1982	4,887	888	18.17	8,509	1,310	15.40	5,733	528	9.21	6,929	859	12.40	5,222	693	13.27	4,792	571	11.92	1,107	152	13.73
1983	4,218	805	19.08	6,993	897	12.83	5,108	385	7.54	6,310	730	11.57	4,466	413	9.25	4,342	485	11.17	1,029	84	8.16
1984	3,831	731	19.08	6,525	879	13.47	5,292	519	9.81	6,197	1,154	18.62	4,247	493	11.61	4,172	689	16.51	990	91	9.19
1985	3,681	634	17.22	5,871	792	13.49	5,446	392	7.20	5,561	1,092	19.64	4,269	577	13.52	4,114	596	14.49	1,433	168	11.72
1986	3,626	474	13.07	5,852	553	9.45	6,206	235	3.79	5,303	468	8.83	4,447	305	6.86	4,103	196	4.78	1,703	203	11.92
1987	3,368	459	13.63	5,674	681	12.00	6,713	346	5.15	5,287	775	14.66	4,527	441	9.74	3,950	449	11.37	1,628	310	19.04
1988	3,494	541	15.48	5,939	669	11.26	7,227	482	6.67	5,628	765	13.59	4,703	513	10.91	4,113	498	12.11	1,913	323	16.88
1989	3,635	479	13.18	6,574	641	9.75	7,576	383	5.06	6,433	702	10.91	5,329	478	8.97	4,035	520	12.89	2,718	384	14.13
1990	4,024	413	10.26	7,472	795	10.64	9,003	599	6.65	7,300	879	12.04	6,002	518	8.63	4,099	494	12.05	4,717	228	4.83
1991	4,337	548	12.64	9,849	153	1.55	8,947	598	6.68	4,973	801	16.11	5,901	609	10.32	3,728	486	13.04	5,314	203	3.82
1992	4,037	587	14.54	8,930	221	2.47	7,974	378	4.74	4,494	706	15.71	5,531	535	9.67	3,366	466	13.84	5,114	210	4.11
1993	3,743	571	15.26	7,413	304	4.10	6,809	464	6.81	4,042	706	17.47	5,151	418	8.11	3,062	442	14.44	4,166	165	3.96
1994	4,167	550	13.20	7,297	331	4.54	6,631	341	5.14	3,960	640	16.16	4,830	407	8.43	3,027	338	11.17	3,815	107	2.80
1995	4,720	560	11.86	6,880	431	6.26	6,348	316	4.98	4,215	531	12.60	4,697	422	8.98	3,373	270	8.00	3,649	156	4.28
1996	5,116	532	10.40	6,367	356	5.59	6,131	358	5.84	4,509	481	10.67	4,608	449	9.74	3,783	307	8.12	3,802	163	4.29
1997	6,382	696	10.91	6,355	407	6.40	5,943	396	6.66	4,835	461	9.53	4,426	433	9.78	4,312	360	8.35	4,139	225	5.44

	Motor Vehicle Body Repairer			Refrigeration & Air Conditioning Mech			Truck and Transport Mechanic			Tool and Die Maker			Painter and Decorator			Plasterer			Bricklayer		
Year	Reg. Total	Comp-letions	Comp Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %
1977	-	-	-	1,352	180	13.31	-	-	-	898	125	13.92	2,009	174	8.66	574	104	18.12	3,086	268	8.68
1978	-	-	-	1,395	226	16.20	-	-	-	1,148	132	11.50	2,065	195	9.44	568	38	6.69	3,019	291	9.64
1979	-	-	-	1,426	176	12.34	-	-	-	1,576	95	6.03	1,908	144	7.55	678	65	9.59	2,994	300	10.02
1980	7,267	935	12.87	1,592	178	11.18	60	-	-	1,825	118	6.47	1,780	115	6.46	674	46	6.82	2,708	209	7.72
1981	7,812	981	12.56	1,783	134	7.52	85	-	-	1,971	52	2.64	2,087	196	9.39	854	49	5.74	2,906	275	9.46
1982	7,459	1,229	16.48	1,898	236	12.43	91	10	10.99	2,204	161	7.30	1,936	179	9.25	838	84	10.02	2,628	332	12.63
1983	6,354	1,084	17.06	1,694	151	8.91	89	12	13.48	2,090	166	7.94	1,800	162	9.00	675	54	8.00	2,183	220	10.08
1984	5,840	1,171	20.05	1,784	215	12.05	87	10	11.49	2,260	337	14.91	1,770	163	9.21	647	62	9.58	2,004	204	10.18
1985	5,292	1,057	19.97	1,875	203	10.84	117	10	8.55	2,293	342	14.91	2,082	208	9.99	802	52	6.48	2,089	183	8.76
1986	5,122	645	12.59	1,957	88	4.50	129	8	6.20	2,385	35	1.47	2,527	137	5.42	1,190	49	4.12	2,759	137	4.97
1987	4,703	676	14.37	1,996	211	10.57	568	62	10.92	2,200	258	11.73	3,001	174	5.80	1,231	40	3.25	3,150	200	6.35
1988	4,745	678	14.29	2,145	208	9.70	637	80	12.56	2,182	366	16.77	2,880	174	6.04	1,529	42	2.75	3,313	197	5.95
1989	4,935	687	13.92	2,374	282	11.88	711	70	9.85	2,046	353	17.25	3,248	126	3.88	1,849	69	3.73	3,753	184	4.90
1990	5,210	742	14.24	2,968	335	11.29	793	100	12.61	2,117	325	15.35	3,734	165	4.42	2,288	71	3.10	4,084	293	7.17
1991	3,910	452	11.56	3,086	377	12.22	756	90	11.90	1,945	288	14.81	3,543	158	4.46	2,249	132	5.87	3,765	361	9.59
1992	3,670	385	10.49	2,981	444	14.89	749	118	15.75	1,697	265	15.62	3,142	189	6.02	2,121	239	11.27	3,352	238	7.10
1993	3,488	353	10.12	2,968	351	11.83	1,043	125	11.98	1,602	230	14.36	2,744	146	5.32	1,907	116	6.08	2,934	168	5.73
1994	3,406	372	10.92	2,994	337	11.26	782	103	13.17	1,617	163	10.08	2,492	105	4.21	1,905	86	4.51	2,535	149	5.88
1995	3,219	273	8.48	3,041	318	10.46	1,206	85	7.05	1,842	154	8.36	2,380	111	4.66	1,892	66	3.49	2,255	158	7.01
1996	3,308	272	8.22	3,191	302	9.46	1,926	107	5.56	2,106	189	8.97	2,293	111	4.84	1,851	55	2.97	1,963	138	7.03
1997	3,396	294	8.66	3,287	371	11.29	2,764	228	8.25	2,401	218	9.08	2,338	115	4.92	1,811	32	1.77	1,802	117	6.49

	Industrial Instrument Mechanic			Roofer			Ironworker			Landscape Gardener		
Year	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %	Reg. Total	Comp-letions	Comp. Ratio, %
1977	473	113	23.89	722	128	17.73	1,474	224	15.20	126	23	18.25
1978	493	94	19.07	873	100	11.45	1,496	278	18.58	168	31	18.45
1979	539	98	18.18	1,166	115	9.86	1,433	256	17.86	207	11	5.31
1980	726	80	11.02	1,111	41	3.69	1,142	132	11.56	236	9	3.81
1981	839	87	10.37	1,443	114	7.90	1,353	129	9.53	277	20	7.22
1982	1,020	143	14.02	1,444	96	6.65	1,452	186	12.81	272	39	14.34
1983	1,042	116	11.13	1,274	91	7.14	1,265	182	14.39	222	11	4.95
1984	1,124	204	18.15	1,202	113	9.40	1,029	187	18.17	234	33	14.10
1985	1,087	190	17.48	1,442	121	8.39	865	166	19.19	250	34	13.60
1986	1,021	136	13.32	1,652	123	7.45	766	42	5.48	275	13	4.73
1987	987	180	18.24	1,789	171	9.56	748	53	7.09	240	35	14.58
1988	1,001	167	16.68	1,553	202	13.01	885	111	12.54	198	33	16.67
1989	1,129	139	12.31	1,739	182	10.47	1,180	107	9.07	180	18	10.00
1990	1,479	161	10.89	2,165	202	9.33	1,615	183	11.33	206	23	11.17
1991	1,638	192	11.72	1,939	231	11.91	2,576	263	10.21	971	48	4.94
1992	1,719	240	13.96	1,716	182	10.61	2,311	234	10.13	1,109	80	7.21
1993	1,750	232	13.26	1,522	119	7.82	1,888	156	8.26	1,203	70	5.82
1994	1,762	221	12.54	1,469	98	6.67	1,659	123	7.41	1,288	93	7.22
1995	1,660	248	14.94	1,429	79	5.53	1,742	118	6.77	1,389	87	6.26
1996	1,638	169	10.32	1,510	94	6.23	1,748	135	7.72	1,453	73	5.02
1997	1,731	192	11.09	1,718	116	6.75	1,680	117	6.96	1,405	68	4.84

Appendix Table A3: Growth Rates of Apprenticeship Registrations in Major Trades (total registrations),(average annual rate of change)

	77-97	77-91	91-97
Landscape Gardener	12.81	15.70	6.35
Cook	9.09	10.83	5.12
Industrial Instrument Mech.	6.70	9.28	0.92
Plasterer	5.91	10.25	-3.55
Hairdresser	5.59	2.23	13.86
Tool and Die Maker	5.04	5.68	3.57
Industrial Electrician	4.75	10.02	-6.59
Refrigeration & Air Conditioning Mech.	4.54	6.07	1.06
Roofer	4.43	7.31	-2.00
Machinist	4.20	4.96	2.46
Welder	3.18	1.73	6.65
Heavy Duty Equipment Operator	2.62	5.63	-4.08
Heavy Duty Equipment Mechanic	1.44	2.26	-0.47
Painter and Decorator	0.76	4.14	-6.69
Plumber	0.67	2.16	-2.73
Industrial Mechanic (millwright)	0.66	1.78	-1.89
Ironworker	0.66	4.07	-6.88
Automotive Service Technician	0.29	1.29	-2.00
Construction Electrician	0.18	1.84	-3.58
Carpenter	0.16	2.87	-5.88
Sheet Metal Worker	-0.05	2.00	-4.68
Steamfitter-Pipefitter	-0.66	2.21	-7.04
Bricklayer	-2.65	1.43	-11.56
Truck and Transport Mechanic	n/a	n/a	24.12
Motor Vehicle Body Repairer	n/a	n/a	-2.32
Top 25 trades	1.40	3.02	-2.28
Other trades	3.31	4.71	0.13
Total	1.70	3.27	-1.86

Source: Statistics Canada/HDRC apprenticeship data base August 1999

Appendix Table A4: Completion Rates by Type of Post-Secondary Education in Canada

	Apprent.	Community College			University-Undergraduate			University-Graduate		
	Compl. Rate, %	Total Enrolment	Diplomas	Compl. Rate, %	Total Enrolment	Undergraduate Degrees, Diplomas and Certificates	Compl. Rate, %	Total Enrolment	Graduate Degrees, Diplomas and Certificates	Compl. Rate, %
1977	14.18									
1978	14.60									
1979	13.41									
1980	10.89									
1981	10.02									
1982	13.40									
1983	11.26									
1984	13.99									
1985	13.72	487,396	84,281	17.29	662,189	114,072	17.23	90,027	18,827	20.91
1986	11.09	487,827	81,767	16.76	670,003	119,958	17.90	92,952	19,810	21.31
1987	11.00	497,350	82,365	16.56	685,681	120,629	17.59	94,879	20,045	21.13
1988	10.67	502,757	80,058	15.92	704,169	122,841	17.44	97,497	20,391	20.91
1989	10.08	502,399	82,506	16.42	719,392	124,903	17.36	100,140	21,206	21.18
1990	9.26	518,060	83,284	16.08	737,243	130,592	17.71	104,085	22,203	21.33
1991	10.22	558,986	85,286	15.26	757,348	136,596	18.04	110,002	23,200	21.09
1992	10.34	548,586	85,949	15.67	771,314	144,061	18.68	114,331	24,811	21.70
1993	10.90	548,402	92,515	16.87	757,918	147,246	19.43	116,686	26,604	22.80
1994	10.14	542,015	95,296	17.58	741,631	150,879	20.34	117,339	27,195	23.18
1995	10.37	548,079	97,195	17.73	729,116	150,803	20.68	117,293	27,263	23.24
1996	9.67	549,062	100,978	18.39	712,958	150,282	21.08	116,810	27,834	23.83
1997	9.51									

Source: Statistics Canada/HRDC Apprenticeship Database, August 1999;
Data for 1985-87 period are from Education in Canada, 1989-90, Cat no.81-229, Statistics Canada; Data for 1988-91 Education in Canada, 1992-93; Data for 1992-96 - Education in Canada, 1998.
Notes: Total enrolment equals the sum of full-time and part-time enrolment.
Undergraduate diplomas, degrees and certificates = Undegraduate level diplomas and certificates + Bachelors and first profession degrees. Graduate diplomas, degrees and certificates = Graduate level diplomas and certificates + Master's degrees + Earned Doctorates.
Enrolment data are in reference to the academic years, graduation data - to the calendar years.

Table A5: Labour Utilization Rate in Construction, Canada

Year	Employed thous.	Unemployed thous.	Potential Labour Supply in hours	Actual Weekly Hours	Total Weekly Hours Worked	Utilization Rate	Unempl. Rate in Construction
	A	B	C=(A+B)*41.0	D	E=A*D	F=E/C*100	G
1976	653.0	86.5	30,319.5	39.3	25,662.9	84.6	
1977	650.8	103.4	30,922.2	38.8	25,251.0	81.7	
1978	651.5	113.4	31,360.9	39.5	25,734.3	82.1	
1979	662.1	93.0	30,959.1	40.3	26,682.6	86.2	
1980	643.8	95.7	30,319.5	39.7	25,558.9	84.3	
1981	674.6	91.4	31,406.0	39.1	26,376.9	84.0	
1982	615.9	144.8	31,188.7	38.2	23,527.4	75.4	
1983	584.9	155.9	30,372.8	38.3	22,401.7	73.8	
1984	591.5	146.1	30,241.6	39.1	23,127.7	76.5	
1985	608.2	127.7	30,171.9	39.4	23,963.1	79.4	
1986	651.6	120.9	31,672.5	39.4	25,673.0	81.1	
1987	716.9	106.3	33,752.9	39.8	28,533.0	84.5	12.9
1988	776.6	102.3	36,035.9	40.5	31,453.7	87.3	11.7
1989	815.4	103.7	37,680.4	**41.0**	33,429.4	88.7	11.3
1990	830.1	141.5	39,835.3	40.5	33,620.1	84.4	14.6
1991	733.8	179.2	37,432.3	39.4	28,910.1	77.2	19.6
1992	712.3	173.1	36,299.7	38.2	27,209.5	75.0	19.5
1993	698.7	161.2	35,258.6	38.8	27,111.2	76.9	18.8
1994	748.5	143.5	36,573.0	40.0	29,940.7	81.9	16.1
1995	722.4	127.8	34,860.6	39.5	28,536.4	81.9	15.0
1996	714.2	117.1	34,082.3	40.1	28,637.7	84.0	14.1
1997	736.9	104.0	34,476.6	40.4	29,768.7	86.3	12.4
1998	760.5	100.8	35,313.3	40.3	30,649.2	86.8	11.7
1999	792.5	92.7	36,290.8	*40.3*	31,936.4	88.0	10.5

Source: Labour Force Historical Review, CDROM 71F0004XCB.
Employed and unemployed for 1987-1999 are from CANSIM series: D980637, D968139;
Pre-1987 data are from Labour Force Historical Review, CDROM 71F0004XCB.
Unemployment Rate in Construction for 1987-1999 are from CANSIM series: D980637
Note: Average per week actual hours in construction for 1999 are assumed to be equal 1998 estimate.
Potential average weekly hours is assumed to equal the maximum average weekly hours experienced over the 1976-99 period.

Table A6
Scenarios for Total Economy Output by Province (average annual rate of change)

	1995-2000		2000-2005		1995-2005	
	Opt.	Pess.	Opt.	Pess.	Opt.	Pess.
Newfoundland	4.4	2.8	4.0	3.0	4.2	2.9
PEI	1.7	0.1	2.4	0.9	2.1	0.5
Nova Scotia	2.2	0.5	2.5	1.2	2.4	0.8
New Brunswick	2.4	0.5	2.8	1.2	2.6	0.8
Quebec	3.6	1.3	3.4	1.5	3.5	1.4
Ontario	4.0	1.5	3.5	1.8	3.8	1.7
Manitoba	2.7	0.7	2.9	1.1	2.8	0.9
Saskatchewan	2.7	0.7	2.7	1.0	2.7	0.9
Alberta	3.1	1.0	2.8	1.5	3.0	1.3
B.C.	3.0	1.2	3.0	1.7	3.0	1.4
Canada	3.3	1.4	3.1	1.6	3.3	1.5

Source: Informetrica (1996) *Planning for Uncertain Times: Canada's Economy and the Construction Industry, Final Report*, prepared for Human Resources Development Canada, April.

Table A7

Trends in Output, Employment, and Productivity in Construction by Province

(average annual rate of change)

	1995-2000		2000-2005		1995-2005	
	Opt.	Pess.	Opt.	Pess.	Opt.	Pess.
Newfoundland						
Real Output	1.2	-3.0	0.9	1.0	1.0	-1.0
Employment	-0.6	-4.8	1.3	1.2	0.4	-1.8
Output per Worker	1.8	1.8	2.2	2.2	2.0	2.0
PEI						
Real Output	-3.2	-5.8	2.2	0.9	-0.5	-2.5
Employment	-5.0	-7.8	0.0	-1.5	-2.5	-4.2
Output per Worker	1.8	2.0	2.2	2.2	2.0	2.1
Nova Scotia						
Real Output	3.8	0.0	2.2	1.0	2.9	0.5
Employment	1.6	-1.8	0.0	-1.0	0.8	-1.4
Output per Worker	2.2	1.8	2.2	2.0	2.2	1.9
New Brunswick						
Real Output	2.1	-0.9	3.8	2.2	2.9	0.7
Employment	0.2	-2.8	1.7	0.0	1.0	-1.4
Output per Worker	2.3	1.9	2.1	2.2	2.2	2.1
Quebec						
Real Output	4.1	0.7	2.0	0.0	3.0	0.4
Employment	2.4	-1.1	-0.5	-2.0	0.9	-1.5
Output per Worker	1.7	1.8	2.5	2.0	2.1	1.9
Ontario						
Real Output	4.9	0.4	3.3	2.2	4.1	1.3
Employment	2.9	-1.5	1.0	0.0	2.0	-0.8
Output per Worker	2.0	1.9	2.3	2.2	2.1	2.1
Manitoba						
Real Output	2.0	-1.7	2.1	0.8	2.1	-0.5
Employment	0.1	-3.3	0.0	-1.5	0.0	-2.4
Output per Worker	2.1	1.6	2.1	2.3	2.1	2.0
Saskatchewan						
Real Output	4.0	0.0	2.0	1.3	3.0	0.7
Employment	2.2	-2.0	-0.2	-0.8	1.0	-1.4
Output per Worker	1.8	2.0	2.2	2.1	2.0	2.1
Alberta						
Real Output	7.0	1.3	1.9	2.0	5.0	1.7
Employment	5.0	-0.3	-0.2	0.0	2.4	-0.1
Output per Worker	2.0	1.6	2.1	2.0	2.1	1.8
B.C.						
Real Output	2.8	-0.8	1.9	2.0	2.4	0.6
Employment	1.0	-2.6	-0.2	-0.2	0.4	-1.4
Output per Worker	1.8	1.8	2.1	2.2	2.0	2.0

Source: Informetrica (1996) *Planning for Uncertain Times: Canada's Economy and the Construction Industry, Final Report*, prepared for Human Resources Development Canada, April.

Table A8

Changes in Labour Demand by Region Prior to Productivity Adjustment
(per cent change)

1995-2000

	All Construction Trades		Labourers	
	Low Growth	High Growth	Low Growth	High Growth
Atlantic	11	43	9	45
Quebec	6	39	-3	36
Ontario	8	42	3	52
Prairies	0	34	-9	35
B.C.	-7	17	-8	31

2000-2005

	All Construction Trades		Labourers	
	Low Growth	High Growth	Low Growth	High Growth
Atlantic	-3	2	-1	-2
Quebec	12	16	23	17
Ontario	17	16	28	10
Prairies	11	14	20	12
B.C.	9	11	21	9

Source: John O'Grady Consulting Ltd. (1997) *Human Resources Needs Analysis: Construction Labourer Trades*, Final Report, September, prepared for the National Steering Committee, page 129 (Atlantic); page 167 (Quebec); pages 198 (Ontario); page 238 (Prairies); page 278 (B.C.).

Table A9
Summary of Projected Persons Employed (@ 1250 hrs/annum) in Canada
1991 – 2005
Construction and Related Sectors
Operating Engineer Trades and Occupations

Occupation	1991	1995	2000	2005
Craning Occupations 9311	3812	3532	3860	4384
Brown Scenario		3515	3450	3816
Orange Scenario		3516	4214	4698
Heavy Equip Mechs 8584	2244	1689	2162	2367
Brown Scenario		1760	1940	2183
Orange Scenario		1761	2337	2638
Heavy Equipment Operators 8711	25250	21250	30260	33382
Brown Scenario		20707	20243	26535
Orange Scenario		20710	30112	34467
Power Shovel/Excavators 8711	7362	7321	8698	9806
Brown Scenario		6751	6950	7218
Orange Scenario		6750	8363	9575
Paving/Excavating Total	11914	10851	11746	13488
Reference				
Plant Operators 8713	1914			
Asphalt Laydown 8713	4710			
Excav/Paving Labour 8718	5290			
Brown Scenario		11272	10310	11597
Orange Scenario		11272	13390	14027

Source: Construction Model and Dalcor Derivations; Dalcor Innoventures Ltd., Peter Warrian Consulting Ltd., and Carol D. MacLeod & Associates (1997) "Human Resource Needs for the Third Millenium": Building Canada's Future Together, Summary Report: Labour Market Analysis for Operating Engineers Trades and Occupations," report prepared for the Operating Engineers Industrial Adjustment Committee, June.

Table A10

Labour Force Projections-Pipe Trades in Canada, 1991-2015

Pipe Trades	1991	1995	2005*	2015*	2015**
Instrumentation Mechanics	6,670	6,966	6,031	4,020	7,221
Plumbers	29,965	29,051	24,195	16,787	28,779
Pipefitters, Steam, Sprinklerfitters	20,395	19,553	14,574	8,001	17,051
Gasfitters	3,895	3,844	3,346	2,275	4,098
Refrigeration Mechanics	10,205	10,567	9,291	6,078	11,906
Subtotal	71,130	69,981	57,437	37,161	69,055
Welders, Solders And Automatic Machine Operators	87,230	83,009	65,573	41,423	65,635
Total		152,990	123,010	78,584	134,690
% Change			-19.6	48.6	-12.0

- * Brown Scenario- High exit rate

** Orange Scenario- Low exit rate

Source: Exhibit B, ARA Consulting Group Inc. (1997) *Pipe Trades National Human Resources Needs Analysis, Final Report*, prepared for the National Steering Committee, January.

Appendix Table A11

Coding of Apprentice Occupations

The coding used for apprentice occupations changed in 1991. The following gives the classification numbers for the top 25 trades for the 1977-90 and 1991-97 periods.

	Occupation	1977-90 Classification	1991-97 Classification
1	Construction Electrician	8733122	873305, 873310
2	Carpenter	8781110	878105, 878110
3	Automotive Service Technician	8581110	858145, 858160, 858165
4	Industrial Mechanic (millwright)	8584112, 8799130 8799158	858420, 858430, 879905 879910, 879915
5	Hairdresser	6143114, 6143118	614310, 614315
6	Cook	6121127	612105, 612110
7	Steamfitter-Pipefitter	8791114	879135
8	Industrial Electrician	8533110	853320
9	Plumber	8791112	879125
10	Welder	8335126	833515
11	Sheet Metal Worker	8333118	833305
12	Heavy Duty Equipment Mechanic	8584122	858415
13	Machinist	8313150, 8313154	831305, 831310, 831325
14	Heavy Duty Equipment Operator	8711110	771705, 871105, 931105 931110, 931120
15	Motor Vehicle Body Repairer	8581118	858130
16	Refrigeration & Air Conditioning Mech.	8733117	873320
17	Painter and Decorator	8785110	331905, 878505, 878510 878515
18	Truck and Transport Mechanic	8581113	858170
19	Tool and Die Maker	8311110	831110
20	Bricklayer	8782110	878205, 878210
21	Plasterer	8784114	878405, 878410, 878420
22	Industrial Instrument Mech.	8588118	858805, 858935
23	Ironworker	8793114	879305, 879310, 879315
24	Landscape Gardener	7195122	719505
25	Roofer	8787118	878705

Source: Apprenticeship Data Base